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Assisting female farmers in exploiting the alternate gainful areas

Dwivedy, Nidhi

Sikkim manipal institution of technology

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List of Contents

<u>No.</u>		<u>Page No.</u>
1.	List of Contents	01
2.	List of Content of Sections	02
3.	List of Tables	04
4.	List of Figures	05
5.	Abstract	06
6.	Background	08
7.	Structure of the Book	09

List of Content of Sections

<u>Section /</u> <u>Sub-Title No.</u>	<u>Title/</u> <u>Sub-Title</u>	<u>Page No.</u>
1.	Introduction	10
1.1	Indian Himalayan Region (IHR)	10
1.2	Sikkim	13
1.3	Agriculture	23
1.4	Constitutional status of women	44
1.5	Conceptualising female Labour in Agricultural Sector	48
1.6	The Investigative Study Question	50
2.	Theoretical Framework	51
2.1	Gender Wise Participation	51
2.2	Share of different sectors in Sikkim	54
2.3	Sericulture	63
2.4	Conclusion	75
2.5	Study Gap	76
3.	Methodology	78
3.1	The Exploratory Research Question	78
3.2	Objectives of the Study	78
3.3	Scope of the Study	78
3.4	Delimitations of the Study	78

3.5	The Hypotheses	78
3.6	Nature of the Study	79
3.7	Research Design	80
3.8	Universe or Population	80
3.9	Sampling Method	80
3.10	Sample Size	81
3.11	Data Collection and Analysis	82
3.12	Sections of the Book	83
3.13	Need of the study	84
4.	Analytical Framework	85
4.1	Inclination of the views for the income they get from their farm	86
4.2	Views about doing anything except agriculture	88
4.3	Inclination of the views to opt for any entrepreneurial activity	89
4.4	Agriculture practices in Sikkim	93
4.5	Integrated low investment rain-water harvesting	95
5.	Conclusion and Recommendations	106
5.1	Conclusion	108
5.2	Recommendations	111
5.3	Scope for future research	113
	References	118

List of Tables

<u>Table No.</u>	<u>Title</u>	<u>Page No.</u>
1.1	Livestock Population	42
2.1	Rural population and agricultural workers (in millions)	53
2.2	Main workers in agriculture, 1991 & 2001	53
2.3	Share of primary, secondary and tertiary sector in total NSDP	55
2.4	Gross state domestic product (GSDP) at factor cost (at current 2004-05 prices)	56
2.5	Gross state domestic product (GSDP) at factor cost (at constant 2004-05 prices)	57
2.6	Households by Type of Fuel Used for Cooking (2001)	59
2.7	Households by Type of Fuel Used for Cooking (2011)	60
3.1	Selection of sample size	81
4.1	One-Sample Statistics for female farmer's views	85
4.2	One-sample test for female farmer's views	86
4.3	Degree of answer for the female farmers's view about the income they get from their farm	87
4.4	Degree of answer for doing anything except agriculture	88
4.5	Degree of answer for the female farmers's view to opt for an entrepreneurial activity	90
4.6	Frequency of various options	91
4.7	District Cross tabulation of various options	92

List of Figures

<u>Figure No.</u>	<u>Title</u>	<u>Page No.</u>
1.1&1.2	Himalayan Region	12
1.3	Districts of Sikkim	13
1.4	Flow Diagram of Vicious circle of climatic change	31
1.5	The flow diagram of an integrated farming system	35
4.1	Inclination of the views for the farm income	87
4.2	Pie diagram for the views of doing anything except agriculture	89
4.3	Line graph for views to opt for any entrepreneurial activity	90
4.4	Bar diagram showing the Frequency of various options	92
4.5-4.15	Figures taken during field survey related to agriculture practices in Sikkim	93

Abstract

The researcher has studied the “Role of female labour in farming sector: a study of state of Sikkim”. Various parameters have been studied under this heading of which farming female’s view to opt for any other activity to augment their income along with farming is one of them. In the region despite majority of the population is dependent on agriculture sector, still it is in the evolving shape and poses a variety of challenges. Social science research in the state of Sikkim is inadequate despite several incentives provided by the state government. The contribution of women in this noble sector is although enormous yet invisible and does not get counted for much. Considering that woman make up the majority of the people in the farming sector with low accessibility and also, now-a-days, with voluminous amount of public expenditure on women empowerment schemes, we cannot ignore this issue thus making it unavoidable to empower them also with the intention to fully utilize their calibre in this field. Keeping this in mind, the present study has analysed the female farmer’s views about opting for any entrepreneurial activity except agriculture to increase their income in the region by collecting data from 230 female farmers through interviews using a pre-designed schedule from 24 circles from all the four districts of Sikkim State. Based on their subjective judgments, female farmer’s views have been measured and analysed using the Statistical Package for the Social Science. Some descriptive statistics, such as percentage as well as one sample t-test of inferential statistics is used to interpret the data. The findings of the study revealed that more number of sample female farmers on an average are interested in and hold the view of doing anything except agriculture and want to opt for any entrepreneurial activity. Results pertaining to these findings have been discussed in this book.

Poor socio-economic condition of the female farmers has also been observed. Therefore, in this book some areas of gainful employment to improve the socio-

economic condition of the stakeholders have also been discussed. Also the state has a target of converting it into a fully organic state by 2015. Therefore an attempt has also been made in this book to overcome female farmer's problems to improve their socio-economic condition & to increase food security by presenting a flow diagram of Integrated Dry land Commercial Farming by Rainwater Harvesting, which can be proved beneficial to the farmers.

Keywords: Farming Females, Allied Agriculture Sector, Sericulture, Sikkim.

- **Background**

Indian agriculture started dating back to ten thousand years and the agriculture was and is a way of living. In India about two third of its population is dependent on agriculture sector. Sikkim is a land of villages and agriculture is the main occupation of population. The place provides a lot of potential in the farming sector to be tapped. The mammoth contribution of women in this noble sector further feminizes the rural poverty by increasing the male out migration. There is great scope to improve the economic status of female farmers through farming sector. The State of Sikkim in North- Eastern India is selected because it has been found in literature survey that social science research in the state of Sikkim is inadequate despite several incentives provided by the state government. The title of the book therefore is “Assisting Female Farmers in Exploiting the Alternate Gainful Areas”. Thus, before proceeding for the study, it is very important to understand the characteristics of location of the study area, for the simple reason that the areas do determine economic and occupational distribution of the inhabitants and their participation in home and farm activities. Moreover, every natural environment has an impact on the civilization that inhabits it and studies on mountainous regions all over the world have substantiated this claim. The impact on life of the people relates to the isolated nature of living on mountains, the need to stand together, to have better security, less access to governmental welfare schemes and resources, the subsequent poverty caused by geographical remoteness and the greater insecurities, caused by life on the borders of nations. The present study has analyzed the female farmer’s views about opting for any entrepreneurial activity except agriculture to increase their income in the rural areas of Sikkim, situated in North- Eastern India. Thereafter, in the book some suggestions have also been made so that with them in place, the socio-economic conditions of the women working in the farming sector can be improved.

- **Structure of the book**

This Book is organized into Five Sections: theoretical focus

Section I. It contains the introduction: the location and characteristics (the geographic, demographic and general) of the study area i.e. Sikkim. Furthermore, the section winds up by expounding about the status of women, female labour in agricultural sector and the Research question.

Section II. It consists of the literature survey which includes gender wise participation, share of different sectors in Sikkim, sericulture. Finally, the section concludes the literature review followed by the research gap.

Section III. The methodology used during fieldwork undertaken from March to September 2011 of all districts of Sikkim is described and a detailed description of the methods employed for data collection and its analysis is included.

Section IV. Result analysis and findings of the primary data collected is covered in this section which is based on the statistical tools applied and the validation of the acceptances or rejection of the hypotheses.

Section V. This section contains conclusion of the findings of the analyzed data and justifies it with the references of the assorted authors of India and other countries. The section wraps up with the suggestions for women.

1. Introduction

1.1 Indian Himalayan region (IHR)

Glaciers play an important role in maintaining ecosystem stability as they act as buffers and regulate the run of water supply from high mountains to the plains during both dry and wet spells. The Himalayan glaciers account for about 70% of the world's non-polar glaciers and affect the lives of millions of people in several countries: China, India, Pakistan, Afghanistan, Nepal and Bangladesh. Their runoff feeds two of the oldest rivers in the world, the Indus and the Ganges, whose tributaries carry precious water for 500 million people on the northern Indian plains. Most of the glaciers in the Himalaya are of a summer accumulation type that is major accumulation and ablation take place simultaneously during summer (Fujita et al., 1997).

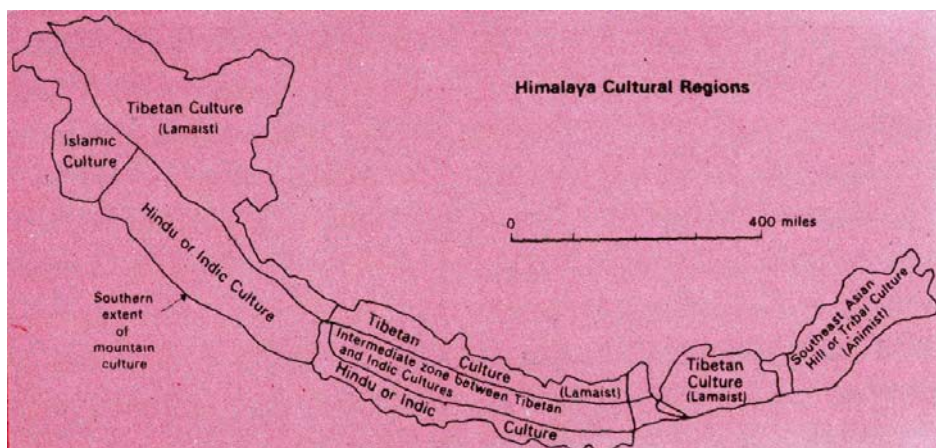
On the basis of the mode of occurrence and dimensions, glaciers have broadly been classified into three categories: valley glaciers, piedmont glaciers and continental glaciers. Himalayan glaciers fall in the category of valley glaciers. It has been estimated that an area of about 32 thousand km² is under permanent cover of ice and snow in the Himalaya (Negi, 1991). This amounts to about 17% of the total geographical area of the Himalaya. Higher concentrations of glaciers in the Himalaya lies in the regions with the highest mountain peaks, that is, Nanga Parbat, Nun Kun, Kinner Kailash, Nanda Devi, Nanda Kot, Annapurna, Mt. Everest, Makalu and Kanchenjunga. There are number of small, medium and large size glaciers in the Himalayan ranges with typical land form features.

It is matter of concern that the Himalayan glaciers are receding at the fastest rates in the world due to global warming, threatening water shortage for millions of people particularly in India, China and Nepal. For instance, the Gangotri glacier is receding

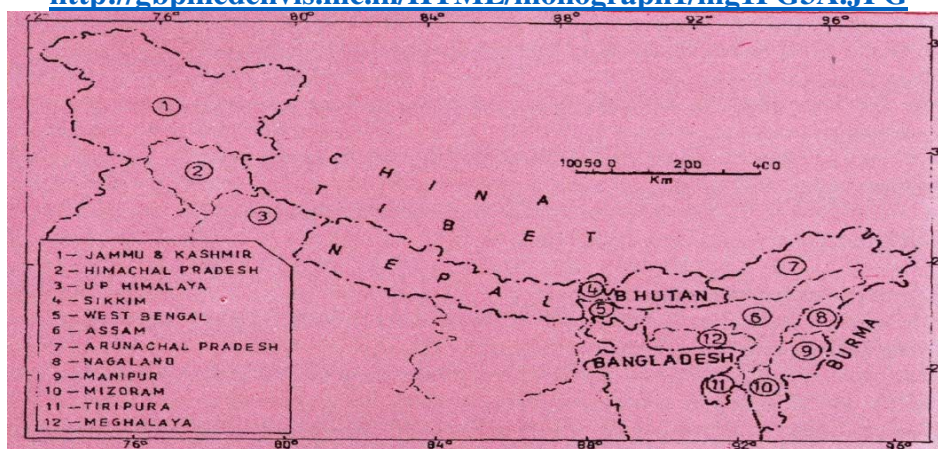
at an average rate of 23 meters per year (Anonymous, 2005, website).

The Himalaya is the youngest mountain chain on the planet and is believed to be still evolving, and thereby, is unstable geologically and geo-morphologically. Because of its extremely active geodynamic condition, even small tampering with the geo-ecological balance can initiate environmental changes that may eventually lead to alarming proportion (Valdiya, 1993, 1997, 2001; Gaur, 1998).

The Himalaya, lying in Indian Territory, is spread over a length of about 2,500 km and a width of 220 to 300 km. It has a total geographical area of approximately 591 thousand km² and is inhabited by about 51 million persons (Rao and Saxena, 1994). It covers partially/fully twelve states/provinces of India viz., Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura, Meghalaya, Assam and West Bengal. Physio-graphically the Himalayan region is grouped as the northern mountains and this group is further identified as (a) Western Himalaya (Kashmir Himalaya and Himachal Himalaya); (b) Central Himalaya (U.P. (now Uttarakhand Himalaya) and (c) Eastern Himalaya (Darjeeling-Assam Himalaya and Purvanchal) (Singh, 1971).



<http://gbpihedenviis.nic.in/HTML/monograph1/mg1PG3A.JPG>



<http://gbpihedenviis.nic.in/HTML/monograph1/mg1PG3B.JPG>

Figures 1.1 & 1.2- Himalayan Region

In the 1960s, the hill areas of India were divided in two categories (i) self-contained politico-administrative units co-terminating with the boundaries of the states/Union Territories which have their own Five Year Development Plans to take care of their development needs. These are referred to as special category states and include Jammu and Kashmir, Himachal Pradesh, Uttarakhand and seven North-eastern states including Sikkim; (ii) the hill areas forming parts of larger composite states confined to the states of Assam and West Bengal are covered by Hill Area Development Programme (HADP), which forms a component of Five Year Plan formulated for the entire state. According to this classification, Sikkim is a Special Category State. Central assistance for its development plans is pre-empted from the divisible pool before making allocations from it to the other States categorized as 'non-Special Category States'. Central assistance is also given on a liberal basis with 90 per cent as grant

and 10 per cent as loan to Sikkim as compared to 30 per cent as grant and 70 per cent as loan to other non-Special Category States.

1.2 Sikkim

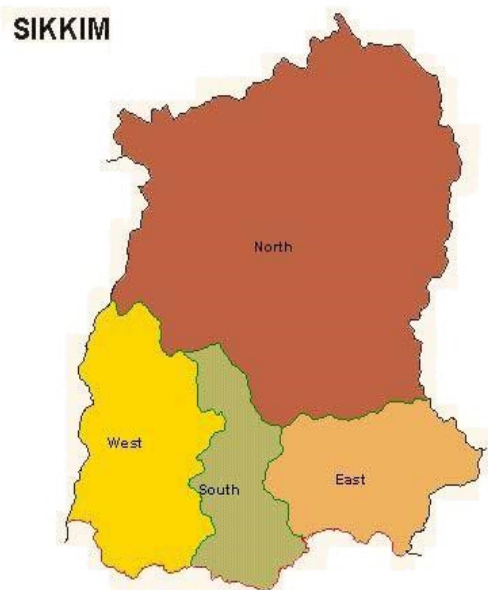


Figure 1.3- Districts of Sikkim

1.2.1 Number of districts

With total area of 7,096 sq. km., the Sikkim is divided into four districts- East, west, North and South.

- **East District**

With a geographical area of 954 sq., km, East District consists of two sub division 45 gram panchayat units, and 144 revenue blocks. With the capital city of Gangtok situated here, East district is the hub of all administrative activity in Sikkim. Due to its altitude Gangtok enjoys a neither-hot-nor-too-cold climate throughout the year.

The temperature does not rise more than 21 degrees centigrade in the summer. The winter can be cold during January. The temperature falls down to zero degree centigrade. The identity of this town is largely depended upon natural beauty and ethnic people, which combine with the modern city life.

- **West District**

Total geographical area of the district is 1116 Sq. Km. The district comprises of two sub- divisions viz. Soreng and Geyzing and six blocks. The districts share its boundaries with Darjeeling district of West Bengal in the South, South District of Sikkim in the East, North district of Sikkim in North East and kingdom of Nepal in the West. The district is watershed of the River Rangit and its tributaries. Three ethnic community viz. Lepchas, Bhutia and Nepali are the inhabitant.

Agriculture in the district is well established. Agricultural land is situated at an elevation of 300-3000m from MSL but most of the cultivated land is below 1800m elevation. Agricultural on 30-50% slope is common but at altitude above 1500m, land with >50% slope has also been brought under cultivation. The climate of the district varies from sub-tropical to alpine depending upon the elevation of the place. Within the same catchment watershed of a stream, subtropical climate observed at the lower elevation while temperate climate prevails in the upper reaches of the stream. Rainfall is heavy and well distributed from May–September, July being the wettest. Rainfall is moderate in other month; sometimes dry spell may prevail from the month of December-March. Within the district some portion receives almost half the rainfall received at high rainfall zone.

- **North District**

With a geographical area of 4226 sq. km, North District consists of two sub divisions and one town. North district occupies the largest area in the state but most of the areas are covered by high hills. Snow Mountains and cultivable area counts less than 11 % (State average) of the geographical area. The district has the diverse agro climate zone right from sub-tropical to alpine. The district is largely inhabited by the tribal population and the agriculture /horticulture mixed with livestock is the main source of livelihood. At present district is coming to be a very renowned tourist destination. The Himalayan range, glaciers, alpine lakes and incomparable pristine natural scenic beauty of the district cannot be found in the other districts of the state. There is good jeep able road from the state capital to the interior part of the district. Infrastructure required for the tourism industry is fast coming up.

Climatically the district is very much suited for the Agriculture/Horticulture and Livestock development programs. Because of the diverse agro climatic zones the district is very suitable for different agro climatic based crops and can go for crop production programme throughout the year. The special feature of the district is that it has a traditional apple growing belt in the upper reaches of the district. Mid hills area is covered by cardamom plantation which is highest in the state. The production of off-season vegetable is the strength of the district.

- **South District**

The South District is a very small district of the hill state of Sikkim. This district covers an area of 750 Sq. km. The district with the headquarters at Namchi comprises of two sub-divisions of Namchi and Ravongla. There are 45 Gram Panchayats units and 26 revenue blocks (including 10 special forest blocks). The district is a part of

inner ranges of mountains of Western Himalayas consisting of higher hills, alpine zones and snow bound areas. The terrain is hilly with narrow incised river valleys with elevations ranging 300 to 5000 m. the slope varies from 80m, to more than 600m per kilometer. The district is almost encircled by the three rivers viz., Great Rangit in the South, Rangit in the West and Tista in the East. These rivers are the main channels of natural drainage.

The temperature varies with altitude and slope. The maximum temperature varies between 15 and 30°C during July and August and the minimum between 2 and 10°C during December and January. The annual rainfall varies from 2000 to 3000 mm. The district is predominantly agricultural with gross cropped area of 75000 ha. The irrigated area of the district is about 5,270.14 Ha, maize is the main crop followed by rice, wheat, pulses, potato and vegetables, which are predominantly grown in hill terraces. In addition to these, a few commercial crops play an important role in the economy of the district. The main occupation of the people is agriculture.

The district is industrially backward with only a few small and medium scale agro based and consumer goods industries located mainly in Melli, Majhitar, Manpur and Jorethang area. The handicraft centers of Namchi and Ralong are producing high quality carpets and other products. Temi is famous for Tea and earns foreign exchange. By and large, the district is rich in agriculture and natural resources and has potentialities for socio-economic development.

The northern portion of the state is deeply cut into steep escarpments and except in the Lachen and Lachung valleys is not populated. Southern Sikkim is lower, more open, and fairly well cultivated. This configuration of the State is partly due to the direction of the main drainage which is southern. The physical configuration of Sikkim is also partly due to geological structure. Major portion of the state is

covered by Precambrian rock and is much younger in age. The Northern, Eastern and Western portion of the state are constituted of hard massive gneissose rocks capable of resisting denudation. The central and southern portion is formed of comparatively soft, thin, slaty and half-schistose rocks which denude very easily. Chief ridges run in a more or less north south direction. The Rangit and the Tista which form the main channels of drainage, run nearly north-south. The valleys cut by these rivers and their chief feeders are very deep. The valleys are rather open towards the top, but usually attain a steep gorge like structure as we approach the bed of the rivers. There are 180 perennial lakes of different altitudes. Many hot water springs i.e. Phur-Cha, Ralang Sachu, Yumthang, Momay are also found in the state. The Perpetual snow line in Sikkim may be approx. at 16,000 ft. Average annual rainfall was found to vary from 1800 mm to 2600 mm over an area of 30 km² in Sikkim Himalaya (Sharma et al., 1992).

1.2.2 Topography/ Geomorphology of Sikkim

Latitude, altitude and continentality are the most influential factors regulating the climatic attributes over large areas in the mountains. Effectiveness of the regional determinants is moderated by the local topographical influences (Barry, 1992). Himalayan Mountain System, instead of running parallel to east-west direction (as is the trend of the mountain system in a general), runs from north-west to south-east direction. The western ranges of Kashmir are located around 360° N while the eastern ranges of Arunachal Pradesh are located around 270° N. Thus, western region including the mountainous areas of Jammu and Kashmir, Himachal Pradesh and Uttar Pradesh have stronger temperate influences compared to eastern sector including Sikkim and Arunachal which for being closed to the equator exhibit more tropical influences. Because of proximity of the Eastern Himalaya to sea (Bay of Bengal) and the unique directions of monsoon originating from the Bay of Bengal

and Arabian Sea, Eastern Himalaya receives more rainfall as compared to the Central and Western Himalaya. The topographical/geomorphologic variations do not straightaway correlate with the latitudinal or continental trends. Indeterminate configurations of valleys and peaks with respect to their length, breadth and altitude result in immense variation in climatic attributes over short distances. Since latitudinal, continental and topographical factors influence the climate in different ways, altitudinal gradient in climatic elements (Baumgartner, 1980) is not likely to be the same all across the Himalaya.

Sikkim is a small Himalayan state lying between 27 to 28 degrees North latitude and 88 to 89 degrees East longitude. The state being a part of inner ranges of the mountains of Himalaya has no open valley and no plains but carried elevations ranging from 300 to 8583 meters above means sea level consisting of lower hill, middle and higher hills, alpine zones and snow bound land, the highest elevation 8583 meters, Mt. Kanchendzonga is on the top of the mountains and it rises in the elevation northward.

1.2.3 Geography of Sikkim

The mystical land under the foothills of the Himalayas, where Mount Kanchendzonga, the guardian of the five treasures, which is considered the guardian deity by its people is the land called Sikkim. Sikkim, meaning "The Valley of Rice" provides a spectacular view of mountains and landscapes and bio-diverse culture.

Sikkim is the second smallest state in India with total area equal to just 115 km by 65 km. It is barely 7,096 sq. km. in size, situated in the Eastern Himalayas spread below the world's third highest mountain Kanchendzonga (8585m). The thumb shaped state borders the kingdom of Nepal in the West, Chumbi Valley of Tibet-Autonomous Region of China to North and East, the kingdom of Bhutan in South-East and

Darjeeling district of W.B. of the Indian state to its South. The State is divided into four districts—South, North, East and West (Registrar General of India, 1989).

1.2.4 Demographic features

According to (Census 2011), Sikkim has a total population of 607 688 persons (which is 0.05 percent of total population of India) of which 321661 are males and 286 027 are females. From the year 1991-01 to 2001-11, decadal population variation recorded was 33.07 to 12.36 percentages, while India's figure for the same is 17.64. In 2011 rural population consists of 480,981 people while urban population consists of 59,870 people. Sex ratio (females per 1000 males) also known as Gender Ratio, in the same decade has shown a little improvement i.e. from 875 to 889 but still lags behind India's, which is 940. Though population density per sq. km. has increased in the same decade from 76 to 86 but is much less than national population density per sq. km. which is equal to 382. Literacy rate in 2001 was 68.81 which rose to 82.20 in 2011 which is above national average of 74.04 percent. This decade has seen an increase in male literacy rate from 76.04 to 87.30 as against all India's rate which is 82.14 and female literacy rate also shows increased figures i.e. from 60.41 to 76.43 as against all India's rate of 65.46.

- **District wise demographic features of the State**

According to 2011 census, **East District** has a total population of 281293 persons, of which 1,50,260 are males and 1, 31, 033 are females. This is the most populated districts of the state and comprises 46.29 percent of the total population. From the year 1991-01 to 2001-11, decadal population variation recorded was 37.32 to 14.80 percentages. Sex ratio has improved in the same decade from 844 to 872 and Population density per sq. km. in the same decade increased from 256 to 295.

Literacy rate in 2001 was 74.68 which rose to 84.67 in 2011. This decade has seen an increase in male literacy rate from 81.20 to 89.22 and female literacy rate from 66.81 to 79.41.

According to 2011 census, **West District** has a total population of 136 299 persons, of which 702 25 are males and are 660 74 females. This district was ranked third by comprising 22.43 percent of the total population. From the year 1991-01 to 2001-11, decadal population variation recorded was 25.57 to 10.59 percentages. Sex ratio has improved in the same decade from 929 to 941 and Population density per sq. km. in the same decade has also gone up i.e. from 106 to 117. Literacy rate in 2001 was 58.81 which rose to 78.69 in 2011. This decade has seen an increase in male literacy rate from 66.82 to 84.86 and female literacy rate from 50.10 to 72.12.

According to 2011 census, **North District** has a total population of 43,354 persons, of which 24,513 are males and are 18,841 females. This is the least populated district of the state and ranked fourth by comprising 7.13 percent of the total population. From the year 1991-01 to 2001-11, decadal population variation recorded was 31.34 to 5.67 percentages. Sex ratio has improved in the same decade from 752 to 769 and population density per sq. km. in the same decade remained same i.e. 10 to 10. Literacy rate in 2001 was 67.21 which rose to 77.39 in 2011. This decade has seen an increase in male literacy rate from 75.69 to 83.03 and female literacy rate from 55.39 to 69.92.

According to 2011 census, **South District** has a total population of 146 742 persons, of which 766 63 are males and 700 79 are females. This is the second most populated district of the state and comprises 24.15 percent of the total population. From the year 1991-01 to 2001-11, decadal population variation recorded was 33.39 to 11.57 percentages. Sex ratio has declined in the same decade from 927 to 914 and

population density per sq. km. in the same decade increased from 175 to 196. Literacy rate in 2001 was 67.31 which rose to 82.07 in 2011. This decade has seen an increase in male literacy rate from 74.29 to 87.06 and female literacy rate from 59.73 to 76.58.

1.2.5 Workers profile

According to (Census 2001), there are 37,936 cultivators (About 26,000 of them are small/medium farmers) out of which 19,725 are males and 18,211 are females in **East** district. Of them 37,889 live in rural and only 47 live in urban area. In rural area 19,701 are males and 18,188 are females. Total no. of agricultural labourers 8,143 out of which 4,076 are males and 4,067 are females. Of them 8,110 live in rural and only 33 live in urban area. In rural area 4,056 are males and 4,054 are females.

There are 35,764 cultivators (About 16,000 of them are small/medium farmers) out of which 20,634 are males and 15,130 are females in **West district**. Of them 35,762 live in rural and only 02 live in urban area. In rural area 20,632 are males and 15,130 are females. Total no. of agricultural labourers in the district are 4,112 out of which 2,389 are males and 1,723 are females. Of them 4,110 live in rural and only 02 live in urban area. In rural area 2,389 are males and 1,721 are females.

There are 9,180 cultivators (About 6,000 of them are small/medium farmers) out of which 4,831 are males and 4,349 are females in **North** district. Of them 9,173 live in rural and only 07 live in urban area. In rural area 4,824 are males and 4,349 are females. Total no. of agricultural labourers in the district are 2,051 out of which 1,045 are males and 1,006 are females. Of them 2,038 live in rural and only 13 live in urban area. In rural area 1,033 are males and 1,005 are females.

There are 48,378 cultivators (About 20,000 of them are small/medium farmers) out of which 24,917 are males and 23,461 are females in **South** district. Of them 48,377 live in rural and only 01 live in urban area. In rural area 24,917 are males and 23,460 are females. Total no. of agricultural labourers in the district are 2,694 out of which 1,252 are males and 1,442 are females. All of them live in rural and no one live in urban area. In rural area 1,252 are males and 1,442 are females.

The above data, showed that in all the districts more than half of the cultivators are small/medium farmers. It was also observed that almost all of them live in rural areas and equal number of females participants were sighted as of men.

1.2.6 Panchayati Raj Institutions (PRI)

This is an age old concept in Sikkim and panchayats have been the backbone of Indian villages. These institutions work as “self-government” as far as implementation of various social and economic programmes for the development of rural areas is concerned. The traditional institution of Dzumsa in the remote areas viz. Lachen and Lachung of North Sikkim is the living example of such social evolution. The role and functions of the Panchayats have been clearly defined in the Sikkim Panchayat Act, 1965. Sikkim has a two-tier system of (PRI) with Zilla Panchayat at the District level and the Gram Panchayat at the village level. It has 9 sub divisions, 92 Zilla Panchayat wards, and 159 units of Gram Panchayat.

There are 50 Gram Panchayat units in East, 49 in West, 20 in North and 45 in South Districts. Various centrally sponsored programmes are being implemented involving PRIs in the districts.

1.3 Agriculture

1.3.1 History and Characteristics of agriculture

Agriculture in India has a long history, dating back to ten thousand years. Indian agriculture began by 9000 BC as a result of early cultivation of plants, and domestication of crops and animals (Gupta page-54, Wikipedia). With the development of agricultural implements and techniques settled life soon started (Harris and Gosden, Lal R., Wikipedia). Double monsoons led to two harvests being reaped in one year (agriculture, Wikipedia). Till the establishment of the British Rule the Indian economy was known for self-contained village community for centuries. The village communities consisted of agriculturists, cottage industrialists, village craftsmen, artisan professions, unskilled workers and village officials. These communities played a major role in meeting not only the needs of the village economy but were also able to produce and ex-port various products to foreign countries. During those times agriculture was a way of living and the farmer produced merely for his self-consumption. The most important crops were food crops like wheat and rice. Since plants and animals were considered essential to their survival, people started worshipping and respecting them (Gupta page 57, Wikipedia).

The middle ages saw irrigation channels reach a new level of sophistication in India and Indian crops affecting the economies of other regions of the world under Islamic patronage (Iqtidar and Shaffer, Wikipedia). Land and water management systems were developed with an aim of providing uniform growth (Palat and Kumar, Wikipedia). However, during British period, when industrial revolution was going on in England (1780-1820), the Britishers forced the farmers to switch over to commercial crops like cotton, indigo and started providing financial assistance to

farmers through zamindars, and British agents to export the surplus cash crops to England. There was continuous exploitation of natural resources and economic wealth from India till Independence was achieved. Due to this economic drain, there was permanent loss of India's national in-come and national wealth. The result was that by mid-nineteenth century, the traditional handicrafts were completely wiped out and the artisans lost their hereditary occupations. This led to their migration to agriculture for their livelihood and it made this sector overcrowded, this process was called 'de-industrialization', which in turn led to stagnation in the Indian Economy. Despite some stagnation during the later modern era, the independent Republic of India was able to develop a comprehensive agricultural program (Roy and Kumar, Wikipedia). The first agricultural census was started by Government of India in the year 1970-71(July-June) as the reference year as part of the 1970 World

Agricultural Census Program sponsored by FAO. It collects agricultural information such as number, area, tenancy, land utilization, cropping pattern and irrigation particulars of different sizes.

The Indian Agricultural Research Institute (IARI), established in 1905, was responsible for the research leading to the "Indian Green Revolution" of the 1970s. The Indian Council of Agricultural Research (ICAR) is the apex body in agriculture and related allied fields, including research and education (Objectives, Wikipedia). The Union Minister of Agriculture is the President of the ICAR. The Indian Agricultural Statistics Research Institute develops new techniques for the design of agricultural experiments, analyses data in agriculture, and specializes in statistical techniques for animal and plant breeding. Recently Government of India has set up Farmers Commission to completely evaluate the agriculture program (Farmers Commission, Wikipedia). However the recommendations have had a mixed reception.

Agriculture provides gainful employment to nearly two-third of the population and contributes about 30% to the national income .This sector supplies raw material to various agro-based industries and also helps in earning foreign exchange. Today, India ranks second world-wide in farm output. India is the largest producer in the world of fresh fruit, anise, fennel, coriander, tropical fresh fruit, jute, pigeon peas, pulses, spices, millets, castor oil seed, sesame seeds, safflower seeds, lemons, limes, cow's milk, dry chilies and peppers, chick peas, cashew nuts, okra, ginger, turmeric guavas, mangoes, goat milk and buffalo milk and meat (Agriculture sector, Wikipedia) Coffee. It also has the world's largest cattle population (281 million) (Lester, Wikipedia). It is the second largest producer of cashews, cabbages, cotton seed and lint, fresh vegetables, garlic, egg-plant, goat meat, silk, nutmeg. mace, cardamom, onions, wheat, rice, sugarcane, lentil, dry beans, groundnut, tea, green peas, cauliflowers, potatoes, pumpkins, squashes, gourds and inland fish. It is the third largest producer of tobacco, sorghum, rapeseed, coconuts, hen's eggs and tomatoes. India accounts for 10% of the world fruit production with first rank in the production of mangoes, papaya, banana and sapota (Indian agriculture, Wikipedia). Despite all these things, though the share of agriculture in the GDP is declining, still it is the largest economic sector and plays a significant role in the overall socio-economic development of India. India's population is growing faster than its ability to produce rice and wheat and as most of India's population depend on rural employment for a living, which is a cause of concern for policy makers (Sengupta, Wikipedia).

Rural sector, as part of any economy, has untapped potential. There are several difficulties confronting the effort to fully explore it. This sector in India, as also in several other developing countries, is still in evolving shape, and the sector poses a variety of challenges.

1.3.2 Challenges of the agriculture sector

In order to understand the challenges faced by agriculture sector in developing nations, some of the common problems faced have been discussed here (Dwivedy Nidhi, 2011).

1.3.2.1 Rudimentary infrastructure and policies lead to slow agricultural growth

Slow agricultural growth is a matter of concern as most of India's population is dependent on rural employment for a living. Current agricultural practices are neither economically nor environmentally sustainable and India's yields for many agricultural commodities are low. Poorly maintained irrigation systems and almost universal lack of good extension services are among the factors responsible. Farmers' access to markets is hampered by poor roads, rudimentary market infrastructure, and excessive regulation ("India Country Overview 2008", Wikipedia).

India has inadequate infrastructure and services because of low investment in it. Farming equipment and infrastructure are scarce outside the provinces of Punjab and Haryana. Because many of the farms are so small in India, the farmers cannot afford irrigation systems that would increase productivity. In India most of the big farms are family owned and run, and they do not take advantage of economies of scale (Economies of scale is the concept that the cost per unit falls as output quantities increase), because the problem of land absenteeism prevalent in big farms is a great hindrance in the development of land and increasing the productivity and the tenant who actually cultivate the land takes little or no care for its development and increasing its productivity.

Low investment in both types of farms (big and small) led to lower production and inefficiency, resulting in higher costs to Indian consumers. This is one of the causes of food inflation in India.

According to World Bank, India's large agricultural subsidies are hampering productivity enhancing investment such as agricultural research and extension, as well as investments in rural infrastructure, and the health and education of the rural people. Though trade reforms in the 1990s helped to improve the incentive framework but overregulation of agricultural domestic trade has increased costs, price risks and uncertainty, undermining the sector's competitiveness. Government intervenes a lot in labour, land, and credit markets.

1.3.2.2 The average size of land holdings is very small

The average size of land holdings is very small (less than 20,000 m²) and is subject to fragmentation due to land ceiling acts, and in some cases, family disputes. Such small holdings are often over-manned, resulting in disguised unemployment and low productivity of labour.

1.3.2.3 Poor socio-economic condition of the farmers

Illiteracy is the root cause of poor socio-economic condition of the farmers and should be tackled at the war footing level. Though the government is taking initiative by adopting the policies like universalization of education, but despite large expenditures in these types of schemes and rural development, a highly centralized bureaucracy with low accountability and inefficient use of public funds limit their impact on poverty. Accompanied by this, lack of technical knowledge and awareness are some of the problems responsible for low productivity of the farmers, adding to the

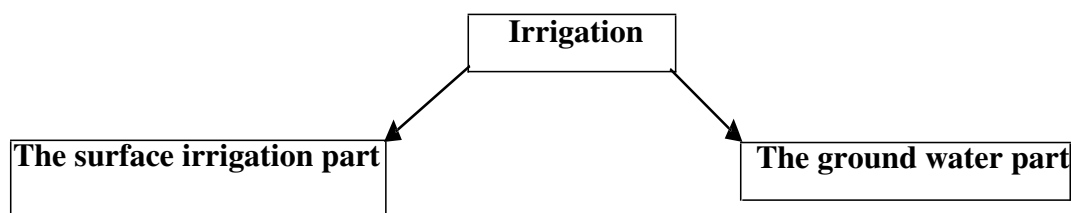
problem of poverty of the farmers. In addition to this, slow progress in implementing land reforms and inadequate or inefficient finance and marketing services for farm produce, inconsistent government policy are the others which add fuel to the fire. Agricultural subsidies and taxes often changed without notice for short term political ends.

1.3.2.4 Use of technology is inadequate

Adoption of modern agricultural practices and use of technology is inadequate, hampered by ignorance of such practices, high costs and impracticality in the case of small land holdings. In India, the farming practices are too haphazard and non-scientific and hence need some forethought before implementing any new technology. However screening of technology is important since all innovations are not relevant or attractive to all areas. Hence it is important to screen them according to the geographical area and the local context of agriculture and use it for the local Kisan Vigyan Kendras (KVKs) to promote. There is, thus the requirement of adoption of appropriate technologies, which would suit the local farming system.

1.3.2.5 Lack of proper management of irrigation

Irrigation in India can be broadly classified into two parts



The issues related to each of these are completely different. As far as surface irrigation is concerned, there are a few major problems. Irrigation facilities are not

only inadequate but the problem of system management also is there. We do not effectively manage water bodies, in terms of how much water is stored, how much is being used for irrigation, or what value we can add to this water. The result of which is that the farmers still have to depend on rainfall, specifically the monsoon season. A good monsoon results in a robust growth for the economy as a whole, while a poor monsoon leads to a sluggish growth. The other is groundwater; the major problem is of equity. Those who have better abilities to extract water take away disproportionately from groundwater aquifers. This gives rise to various problems. One is that if groundwater is closer to the coastal area, groundwater may get mixed with salt which affects everybody and is a negative externality. In many other places, groundwater level goes down drastically and often the wells go dry, making it difficult to get even drinking water. At the same time over pumping made possible by subsidized electric power is leading to an alarming drop in aquifer ([^ Satellites](#), [^ Columbia](#), [^ Keepers](#), Wikipedia). World Bank also says that the allocation of water is inefficient, unsustainable and inequitable. It creates dual problems - related to availability of drinking water as well as access of ground water to the poor.

1.3.2.6 Agriculture sector faces the disastrous consequences of hazards

Indian agriculture is prone to all possible hazards which often end up in disasters. Unique geo-climatic conditions make the country vulnerable to hazards and disasters, which are both natural and human, induced. The common natural hazards in India are floods, cyclones, landslides, forest fires, avalanches and pest/disease out breaks in plants and animals, besides earthquakes (experienced while conducting this study in Sikkim on 18 September, 2011 measuring 6.9 on richter scale) and Tsunami. Besides, the manmade disasters are fire, incidence of spurious seed, fertilizers and pesticides and price fluctuations. While natural hazards are instant events that occur within hours due to nature's fury with disastrous consequences; drought, which is

characterized by lower than normal precipitation and slow in onset is a progressive phenomenon caused by soil conditions and atmospheric changes over a period of time which impact not only crops but also livestock and human beings as well as non-agriculture sector which are dependent upon it. In such scenario, with inadequate risk mitigation support and almost negligible non-farm employment, farmer's life (especially of small and marginal ones) has become very complex and difficult. One cannot have any control over natural disasters. But with better preparedness, we can help in mitigating manmade disasters and the losses of the farmers.

About 60% of the landmass is prone to earthquakes of varying intensities, over 40 million hectares is prone to floods, about 8% to cyclones and 68% to drought (Ghosh and Chowrasia, 2010). The super cyclone in Orissa in 1999, the Bhuj earthquake in Gujarat in Jan. 2001, Sikkim earthquake on 18 September, the Tsunami in Bay of Bengal in Dec. 2004 and recent floods in Punjab and Haryana are the examples of large scale disasters in recent times. The consequences of them are even more disastrous that sometimes farmers compromise the willingness to take risk in farm entrepreneurship.

1.3.2.7 Dependence of agriculture on weather

Agriculture not only in India, but world over especially in developing countries, depends on monsoon, because in these countries irrigation facilities are not fully developed. In case monsoon fails or it rains heavily untimely, it ruins the agricultural production. Agriculture has become a gamble not only for monsoon but also for temperature now-a-days. With increase in temperature than what a particular crop requires, it affects negatively the productivity of that crop. The present insurance system in India also does not cater much for any loss of crop failure due to any unfavourable and unavoidable climatic conditions or pest epidemics. Small farmers

who have taken loans to raise the crops come under heavy debts in such situations and if this situation prolongs for many years it further forces the poor farmers to starve and sometimes this leads to suicides by aggrieved farmers as reported in Maharashtra and Andhra Pradesh.

1.3.2.8 Vicious circle of climatic change

The Flow Diagram of Vicious circle of climatic change is depicted at Fig 1 below.

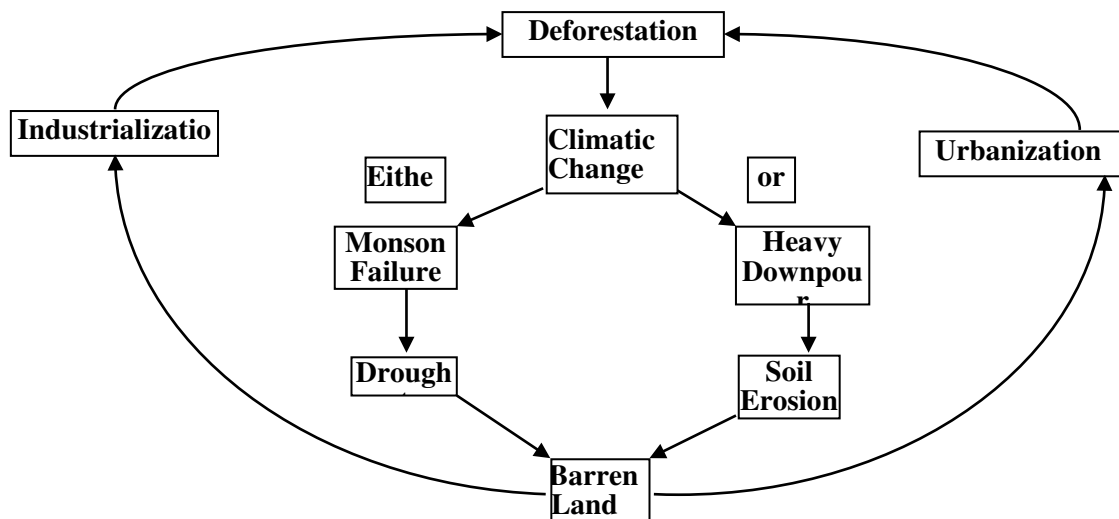


Fig 1.4- Flow Diagram of Vicious circle of climatic change

For the sake of industrialization and urbanization, more and more trees have been cut, leading to global warming and causing imbalance in climatic conditions thereby making farming occupation even harder. It also makes the land barren. The barren land is caused by-

either-

- a) Soil erosion due to deforestation activities causing imbalance in climatic conditions leading to heavy downpour or flash floods.

or-

- b) Dry land and drought due to monsoon failure.

The barren land forces the farmers in distress selling of it to traders and builders, who earn money by reselling it at exorbitant prices for commercial purpose like urbanization and industrialization. The world which is already facing the problem of global warming, it further gets aggravated by such practices. From this, again the vicious circle starts. The shrinking of farm land paves the way to food security problems. There is no denying the fact that a dry land is not nature made but manmade. When one goes on cutting trees, over a period of time the area becomes barren and unproductive due to absence of surface water and ground water recharge. (Prabu M. J., 2010).

1.3.2.9 Disasters leading to rural poverty

There has been continuous increase in rural poverty. It has twin characteristics-

- (a) Poverty of rural human beings
- (b) Poverty of weather prone rural area

Reason for degradation of natural resources and poverty can be any –

- a) It can be a drought/flood because of global warming
- OR
- b) Modern farming methods

It affects the land negatively and ultimately making the rural people poor.

The first one leaves the land barren and the second one, which though is costly but leads to large scale economies. Because of high returns, farmers get tempted towards it without giving a second thought to its ill effects. The poor who cannot afford it

further fall into the trap of poverty because, they cannot compete with the rich farmers and casual labours even lose their jobs with introduction of mechanization. So, to remove rural poverty there is a need that small farmers and women to be integrated in the development effort, so that they also contribute in the removal of poverty.

1.3.2.10 Climate change will lead to increased hardship for India's poorest women

Himalayan glaciers are also receding at the fastest rates due to global warming, threatening water shortage for millions of people particularly in India, China and Nepal. Climate change will lead to increased hardship for India's poorest women. Women in India, especially in rural areas, are often responsible for providing daily essentials such as food and water. When climate change related disasters strike, researches have shown that the workload of women and girls increases, thus leading to their exclusion from opportunities like education and a diminishment in their equal participation in development. For example, deforestation increases the time women need to spend looking for fuel. Research has further shown that women have fewer means to adapt and prepare for extreme weather conditions. Many poor women are also actively engaged in agricultural activities, including paddy cultivation and fishing that will be affected by changing weather patterns in India; loss of livelihood will increase their vulnerability and marginalization (UNDP 2007/8).

- **Understanding of the problem in the right perspective**

Before going for finding out the solution for our problems of rural deprivation, it is very important to understand the problem first. We should be very clear about the direction we want to proceed with - removal of rural poverty or fast tracking neo-liberal rural development? If we want to move ahead with the second one, then we all

are also a part of contemporary version of the ancient cult-ritual, i.e. human sacrifice (Narbali).

There are 2 ways of looking at the problem. A glass half full or half empty. If we look from half- full side and understand that water is not a problem but a solution of our problem i.e. by innovating the ways of farming which give good result with scanty water and innovating the ways to conserve soil and water, then only we can move forward on the sustainable path of development to remove rural deprivation.

1.3.3 Remedial measures

The pressure which comes with the continuous increase in human demographic statistics exerts itself first on the best land and tends to marginalize extensive production. Accordingly, the integration of crop farming and livestock husbandry i.e. mixed/ integrated farming becomes imperative. Mixed farming improves the employment opportunities and standing of small farmers in rural areas. In the present study, mixed farming is defined as a system of farming in which both crop and livestock farming are combined for the purpose of meeting family requirements and profiting from both enterprises. It is also an important strategy to increase the income of resource poor farmers.

1.3.3.1 Integrated Farming

Integrated farming system (IFS) or integrated agriculture is a commonly and broadly used word to explain a more integrated approach to farming as compared to monoculture approaches. It refers to agricultural systems that integrate livestock and crop production and may sometimes be known as Integrated Bio-systems. For example-

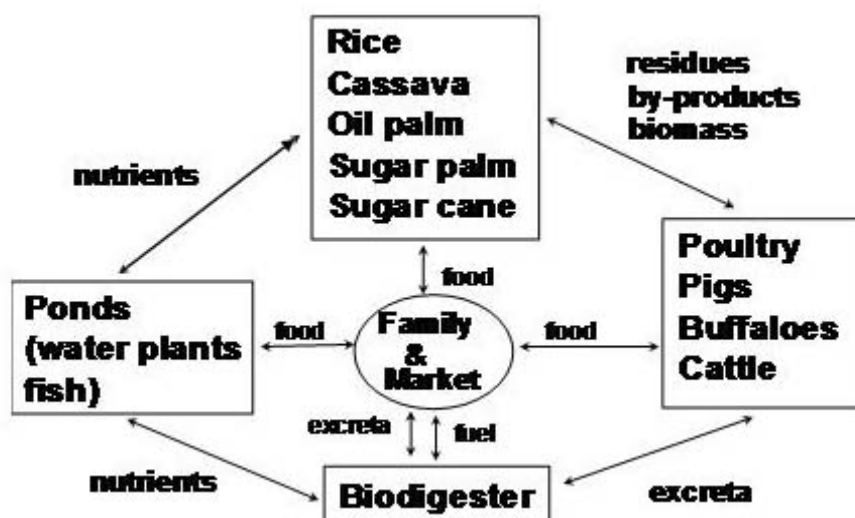
"Pig Tractor" systems where the animals are allowed to graze in crop fields well prior to planting and "plough" the field by digging for roots.

Poultry used in orchards or vineyards after harvest to clear rotten fruit and weeds while fertilizing the soil.

Sikkim has a hilly terrain and small size of land holdings, therefore integrated agriculture is the best suited for this type of area.

1.3.3.1.1 Functioning of Bio-digesters in an integrated farming system

The use of tubular plastic bio-digesters for anaerobic digestion to convert organic matter to biogas and effluent (Botero and Preston 1995) is a very simple and practical system that is flexible and uses low-cost materials (Preston and Rodríguez 2002; Mette 1998; Bui Xuan An et al 1997) when compare to other types of bio-digester (Mikkle et al 1996; Timothy and Gohl 1996). It is an agricultural system that provides way for effective and efficient recycling of farm and animal nutrients producing fuel and fertilizer in the process. The effluent from the bio- digester is a replacement for chemical fertilizer for use on land crops, or in ponds for production of water plants and fish (Preston 2000; Barbara 2000).



1.5-The flow diagram of an integrated farming system (Source: Preston 2000)

The result of the anaerobic digestion is the production of a biogas mixture of methane and carbon dioxide. The composition of biogas varies depending on the raw materials, the organic load applied, the time and temperature. On average, it is about equivalent to the following: methane (CH₄) 55-65%, carbon dioxide (CO₂) 35-45%, nitrogen (N₂) 0-3%, hydrogen (H₂) 0-1% and hydrogen sulphide (H₂S) 0-1%. Biogas is about 20 percent lighter than air and has an ignition temperature in the range of 650 to 750 °C. It is an odorless and colourless biogas that burns with a blue flame similar to that of Liquefied Petroleum Gas (LPG) (Sathianathan 1975). The effluent from the digester has from 60 to 80% less BOD (Biological Oxygen Demand) compared with the input material (Arthur 2000). It has been shown to be a high quality fertilizer (Preston and Rodríguez 2002; Le Ha Chau 1998a, b).

In research in Cambodia, it was observed that with daily loading of 5 kg manure solids, one cubic meter of digester capacity (liquid volume) would produce about 1.61 m³ biogas daily (San Thy et al 2003). Thus for a family of 6 in the developing world, digester systems of liquid capacity of 4 to 6 m³ can meet the daily biogas requirements. A similar conclusion was reached by (Luitweiler, No date, website). Along with household consumption this energy can be used to light livestock sheds as well as pond sites.

The changes that take place in the substrate during the digestion process have received less attention and have been concerned mainly with environmental and health issues. Thus the degree of reduction in the Biological Oxygen Demand (BOD) and in the concentration of pathogenic micro-organisms has been major areas of interest (Chara et al 1999; Vieyra 2000).

Recently, attention has focused more on the fertilizer value of the effluent and specifically on comparisons of the effluent with the raw manure used to charge the

digesters. Thus (Le Ha Chau 1998a) showed that the biomass yield and the protein content of cassava foliage were significantly increased when biodigester effluent, derived from either pig or cow manure, was used to fertilize the cassava as compared with the same amount of nitrogen applied in the form of the raw manure used to charge the biodigester. Similar findings were reported for duckweed grown in ponds fertilized with the effluent or the raw manure (Le Ha Chau, 1998b). (Kean Sophea and Preston 2001) recorded a linear response in biomass yield of water spinach (*Ipomoea acuatica*), which reached 2.4 tonnes dry matter /ha in a 28 day growing period with a level of effluent equivalent to 70 kg N/ha. Studies show that recycling manure through earthworms also improves the fertilizer value. Maize plants grew at twice the rate on worm compost compared with the original manure (Nguyen Quang Suc et al 2000). A report from research in Vietnam from April to December 2004 (Chat Tran Hoang et. al., 2005), has confirmed the superior value of compost from earthworms to urea in promoting biomass growth and crude protein content of water spinach and further added on that the most economical level of N is 40 kg/ha applied over the 28 day growth period. The study also validated that in contrast to use of urea, application of worm compost had beneficial effects on soil fertility when this was measured biologically and chemically.

Reports from China claimed higher productivity in fish ponds when biodigester effluent was used in comparison with raw manure (Ding Jieyi and Han Yujin, 1984). A report from research in Cambodia (Pich Sophin and Preston 2001), has confirmed the superior value of effluent from a biodigester charged with pig manure compared with the same manure applied directly to the pond at comparable levels of nitrogen.

1.3.4 Agriculture policy initiative of State Government

The draft plan document for 11th plan (2007-2012), prepared by the state Government, has been tentatively approved by the planning commission, Government of India. The draft approach paper of the plan for agriculture aims at:

1.3.4.1 Agriculture policy in Sikkim

- a) Organic farming to be popularized with emphasis on improved rural and vermin composting technologies and use of bio-fertilizers.
- b) Increasing production of food grains by adopting suitable crop management technologies and introduction of intensive cultivation.
- c) Adoption of dry-land farming technologies and mixed farming.
- d) Production and distribution of quality seeds.
- e) Cultivation of commercial crops with adoption of multiple cropping patterns.
- f) Adoption of farm mechanization for improving productivity and efficiency in agriculture.
- g) Development of water harvesting structures for irrigation.
- h) Creation of additional storage facilities for agricultural produce.

1.3.4.2 Farming strategies adopted by the agriculture department in the State

The state has a target of converting it into a fully organic state by 2015. In this regard, the Department has started a lot of measures to replace the chemical fertilizers by using bio fertilizers and organic manures. Effective Microorganism (EM) technology in production of compost and bokashi and bio-pesticide is being

propagated among the farmers in technical collaboration with MAPLE ORTECH, Dehradun to give boost to organic farming in Sikkim. Integrated Pest Management (IPM) technology is being practiced to control the pests. Predators are produced in Sikkim State IPM Lab and are released in the farmers' field as and when required. The Government has set up a livelihood school also on organic farming at Tadong, Gangtok. This is first of its' type in the country. Participants will be given 3 months training on organic farming processes. Trained youths will go to villages and assist farmers at village level. Popularization of HYV seeds, production of quality seeds, mixed cropping, pest management through Farmers Field Schools (FFS), recycling of farm waste for compost production, soil reclamation by liming, seed treatment campaign and integrated farming through watershed approach are some of the strategies adopted by the Department in the state.

1.3.4.3 Mechanization has varied connotations

While in the developed world it tends to be synonymous to automation but in developing countries, like India especially in hilly areas, mechanization means any improved tool, implement, machinery or structure that assists in enhancement of workers' output, multiplies the human effort, supplements or substitutes human labour, avoids drudgery or stresses that adversely affect human mental activities leading to errors, imprecision and hazards and eventually loss of efficiency. It also means automation and controls that assure quality and hygiene. Agricultural mechanization in a limited sense relates to production agriculture.

Farming with machinery in Sikkim is almost non-existent. However power operated Thresher, Hand Winnowing, Hand Maize Sheller, Iron Plough and other gender friendly machineries have been introduced on experimental basis. Sprinkler and drip irrigation has been taken up on demonstration basis. Agriculture in the state is mainly

rain fed. Farm mechanization here in Sikkim is meant for increasing the production and productivity, comfort and safety, return and profitability to farmer.

In rural areas various central government sponsored programmes-Swarnajayanti Gram Swarajgar Yojna (SGSY), Indira Awas Yojna (IAY), Sampoorna Grameen Rozgar Yojna (SGRY), National Rural Employment Guarantee Scheme (NREGS), Prime Minister's Employment Generation Programme (PMEGP), Margin money scheme of The Khadi and Village Industries Commission(KVIC)are being implemented involving PRIs in the State/districts.

The Prime Minister's Employment Generation Programme (PMEGP) is the result of the merger of two schemes - Prime Minister's Rojgar Yojana (PMRY) and The Rural Employment Generation Programme (REGP). Under the scheme, the beneficiary is required to invest his/her own contribution of 10 per cent of the project cost. In case of Schedule Castes/Schedule Tribes and beneficiaries from other weaker sections, the beneficiary's contribution is 5 per cent of the project cost. The remaining 90 and 95% as of the project cost, as the case may be, is granted by banks specified under the scheme.

1.3.4.4 Minor irrigation: (Surface Water)

Sikkim is a mountainous State with steep rugged hills, narrow valleys and rocky terrain. The topographical condition does not favour major or medium irrigation schemes and as such all irrigation schemes in the State fall under surface flow Minor Irrigation Schemes category. As the cultivable command areas to be covered by individual schemes are much less than 2,000 Hectares, which is also the minimum coverage, required to be created under any Medium Irrigation Schemes as per the national norm. Because of this constraint, the possibility of taking any scheme under medium/ major irrigation is not feasible in Sikkim.

1.3.4.5 Agriculture and Allied Sector

Agriculture is the mainstay of the Indian economy because of its high share in employment and livelihood creation. It supports more than half a billion people providing employment to 52 per cent of the workforce. Its contribution to the nation's GDP is about 18.5 per cent in 2006-07. It is also an important source of raw material and demand for many industrial products, particularly fertilizers, pesticides, agricultural implements and a variety of consumer goods.

Agriculture and allied' industry is further divided into several segments, namely: - horticulture and its allied sectors (including fruits and vegetables, flowers, plantation crops, spices, aromatic and medicinal plants); fisheries sector; animal husbandry and livestock; and sericulture. Agriculture and allied sectors have contributed 25.2 per cent to the gross state domestic product (GSDP) of Sikkim (<http://business.gov.in/agriculture/animal.php>).

1.3.4.5.1 Animal Husbandry and livestock in Sikkim

In a predominantly rural economy such as Sikkim, animal husbandry activities form an extremely important element in the effort to bring about substantial improvements in living standards. In hilly areas, availability of land to agricultural practices is not sufficient. Most of the land is occupied by forests and pasture lands. On the other hand, burden of population on agriculture is tremendously increasing. The overall area available for agriculture operations in Sikkim is limited to about 15% of the geographical area of the state accompanied by small land holdings in the State as is seen in the above figures and secondly because of the policy of the State Government, deforestation for the sake of agriculture is not allowed. So, with the increasing population, per capita land availability has been consistently declining. It is therefore, essential, that supplementary sources of income are developed in order

to provide not only the much needed support to the rural families but also to make available an increasing quantity of protein rich food items such as milk, egg and meat. Adequate number of livestock like cows, pigs, sheep, goats, yaks and few other are reared in Sikkim and their number is increasing over a period of time especially of small animals. As we can see from the Table 1 below, there is an almost 50% increase in the population of pigs, goats and poultry from the census 1997 to census 2003.

Table 1.1 Livestock Population

Sr. No.	Livestock	Census-1997	Census-2003	% Increase
1	Cattle	143024	160932	12.52
2	Buffaloes	1970	2118	07.51
3	Sheep	5023	5746	14.39
4	Pigs	26975	40938	51.76
5	Goats	82980	123841	49.24
6	Poultry	219552	321919	46.63
7	Yak	4731	5719	20.88

Source: Department of AH and VS, Government of Sikkim

Dairy farming, piggery, sheep rearing and goateries are the traditional activities in the state, which fulfill the demand for milk, wool, mutton and pork as well as to improve the socio economic condition of the people of the state. Poultry farming is undertaken on small scale by small farmers and SHGs. The state Government has also announced the Poultry Mission, 2009-2012 with provision of subsidized inputs, development of infrastructures etc.

1.3.4.5.2 Sericulture in Sikkim

The practice of sericulture farming is rural /farmer oriented and is aimed at increasing the income level of poor and backward farmers. The sericulture programme has been being implemented in the state, its real push and momentum was given by the government in 1998 when it announced rupees five crores in five year plans. It was soon followed by the creation of a separate directorate under the forest, environment

and wildlife department to function as a distinct identity. Facilities such as providing low cost rearing houses, mulberry saplings, silkworm seeds, rearing appliances are being given. One month long training programmes are being conducted at Jorethang centre. Mulberry, Muga, Eri, Oak-Tussar and silk are cultivated in Sikkim. The Sericulture Department of Sikkim promotes exports of silk from Sikkim. The State has a suitable climate for agricultural and horticultural products.

1.3.4.5.3 Fisheries in Sikkim

The 'fisheries and aquaculture sector' is recognized as the sunshine sector in Indian agriculture. The 'Department of Animal Husbandry, Dairying and Fisheries' is the main authority for development of fisheries' industry in India. However, fishery is basically a State subject and the primary responsibility for its development mainly rests with the State Governments. It helps in generating employment and improving welfare and socio-economic status of fishermen.

Despite enormous water resources in the form of river, rivulets and springs, pisciculture is not a popular activity in the state. But capture fishing is carried on in the streams in a very limited and scattered manner. With the development of secondary and tertiary sector, the demand for fish is also increasing continuously. To fulfill this demand, 145.28 tonnes of fish was imported through Rangpo check post during 2007-2008(Fisheries Department).

During XI plan, the department has adopted the following strategies for the development of pisciculture in the state.

- a) Increase the fish and fish seed production.
- b) Propagation of sport fisheries.

- c) Lab to land programme by extension programme.
- d) Research and survey programmes to support the development of fisheries.
- e) Encouraging Trout culture.

The department is also implementing two projects viz. Border Area Development Project and Pilot Project on cold water fisheries. Both the projects were connected with the development of high altitude cold water fish species i.e. Trout.

1.4 Constitutional status of women

Women empowerment is one of the central issues in the process of development not only in India but world over. In India, it was with the declaration of the decade 1975-85 as women's decade that the official recognition was given to the importance of studying various facets of the role of women in prod/reproduction. The planning commission in its sixth plan (1980-85) gave more emphasis for the cause of women. However, formal earmarking of funds for women started with 7th plan (1985-86 to 1989-90) and The National Commission for Women was set up by an Act of Parliament in 1990 to safeguard the rights and legal entitlements of women. The 73rd and 74th Amendments (1993) to the Constitution of India have provided for reservation of seats in the local bodies of Panchayats and Municipalities for women, laying a strong foundation for their participation in decision making at the local levels. The Government of India made empowerment of women as one of the principal objectives during 9th five year plan (1997-2002) and ushered in the new millennium by declaring the year 2001 as 'Women's Empowerment Year'.

The most common explanation of 'women's empowerment' is the ability to exercise full control over one's actions. There has been shift in policy approaches from the concept of 'welfare' in the seventies to 'development' in the eighties and now to 'empowerment' since the nineties. The constitution not only grants equality to

women but also empowers the state to adopt measures of positive discrimination in favour of women. It underscores women's right, health, women education, gender equality, decision making, poverty eradication and violence against women.

1.4.1 Gender equality

Gender disparity manifests itself in various forms, the most obvious being the trend of continuously declining female ratio in the population in the last few decades. Social stereotyping and violence at the domestic and societal levels are some of the other manifestations. In most Indian families, women do not own any property in their own names, and do not get a share of parental property (Kalyani and Kumar, 2001, Wikipedia). Due to weak enforcement of laws protecting them, women continue to have little access to land and property (Carol S. June, 1998). In fact, some of the laws discriminate against women, when it comes to land and property rights. The Hindu personal laws of mid-1950s (applied to Hindus, Buddhists, Sikhs and Jains) gave women rights to inheritance. However, the sons had an independent share in the ancestral property, while the daughters' shares were based on the share received by their father. Hence, a father could effectively disinherit a daughter by renouncing his share of the ancestral property, but the son will continue to have a share in his own right. Additionally, married daughters, even those facing marital harassment, had no residential rights in the ancestral home. After amendment of Hindu laws in 2005, now women have been provided the same status as that of men (THE HINDU, 2005). The United Nations has also outlined seven interdependent strategic priorities with regard to Millennium Development Goals (MDGs-3) in altering discrimination against women. Two strategies are to ensure women's property and inheritance rights and to eliminate gender inequality in economic sectors (World Bank, 2007). The 4th World Congress of Rural Women, held in South Africa in 2007, reiterated the need to provide full and equal access for rural women to productive resources, including the right to inheritance and ownership of land and

other property, credit/capital, appropriate technologies, markets and information.

Women agricultural workers are occupying very low positions in the agrarian hierarchy. In terms of gender, rural women bear the burden of poverty and exploitation more heavily than men. Women's participation in agricultural production is related to the decline in farm size and persistent poverty. Women and all "weaker" groups in general, are virtually inarticulate victims of the principle of equality in an unequal social context. Women are generally perceived to be patient, dependent and passive and their work is considered to be unexciting and repetitive. In fact, women are naturally mothers, and their greatest pleasure and true fulfillment lies in maternity, the one out of a few things that women are good at (Deckard, 1983). These kinds of ideologies about women have tended to marginalize women and have belittled women's work in the home and outside the home and therefore women's contribution to economic wellbeing of the home and society. To correct this imbalance and to reverse the marginalization of women it was necessary for both men and women to realize that women are not treated as equals of men. And, so long as gender is an important indicator of economic social and political roles, there will be a need for special policies targeted to rural women for education and training, technology transfer, and credit (Rajula Devi A.K., 1989).

Despite economic disparity and woeful neglect, women have been the embodiment of sacrifice, surrendering all their comforts for the welfare of the children and other members of the family and indirectly for the well-being of the community that we can call her unsung heroine of our country, who without any publicity contributes her best to the progress and welfare of the country.

1.4.2 Need of gender-disaggregated data in agriculture

- **Lack of gender-disaggregated data could hold back agricultural development**

Male and female farmers are affected differently by agricultural policies and programmes because of their diverse yet often complementary roles and responsibilities in agricultural production, disparities in their access to and control over productive resources and the existence of social norms and legal legislations that often favour men over women (FAO, 2010, website). Gender-disaggregated agricultural data can be used to illustrate economic, social and political differences that may exist between male and female farmers, to assess the possible impacts of these differences on their production and productivity, and to better understand and recognize men and women's (changing) roles and responsibilities related to the agricultural sector, rural development and food security. The need for more gender-disaggregated data was already highlighted as a prerequisite for obtaining more equitable development in the world in a Plan of Action adopted at the First World Conference on Women (1975). Concerning the agricultural sector, the need for this kind of data became more apparent as evidence grew that human capital is a crucial factor for agricultural development and that a lack of gender-disaggregated data could hold back agricultural development. Agricultural plans formulated on the basis of inadequate information contributed to a low impact of policy and planning efforts and the wastage of scarce human, financial and environmental resources (FAO, 2005b).

For improving the socio-economic condition of women, the efforts of the State Government as well as of different NGOs are also very significant. Various development agencies have undertaken some initiatives and programmes focusing on education and capacity building, credit, health and nutrition, political empowerment, gender awareness, human rights and oppression. Some innovative steps taken in the Sikkim State like free education for daughters with special stipends, reservation of seats for women in local government, special quota in services and amendment of

laws have been promoting women's empowerment as well as reducing the gender disparity.

1.5 Conceptualising female labour in agricultural sector

1.5.1 Concept of labour

Any work manual or mental undertaken for certain pecuniary consideration is termed as 'labour' in economics. All labour is directed towards producing some effect or change. This of course excludes activity undertaken with an objective of amusement merely for own sake, it does not constitute as labour. (Marshall Alfred, 1964) has defined labour as, "Any exertion of mind or body undergone partly or wholly with a view to some good other than the pleasure, derived directly from the work." Labour in this sense includes, the very highest professional skill of all kind as well as the labour of unskilled workers and artisans and of those employed in education, in fine arts, in literature, in science, in administration of justice and in the Government in all its branches.

1.5.2 Role of female labour in agricultural sector

Role of female labour in agricultural sector can be classified as follows (Samnohtra Nidhi, 1992). (Chattopadhyay Manabendu, 1982) in his study has also done the same classification: -

- (a) Contribution of labour in agricultural production.
- (b) Management of cattle and other farm animals.
- (c) Pre-harvest activities, and
- (d) Post harvest management, such as, providing labour for storage of seed, food grains, processing and marketing.

Not much endeavor has been done to assess the enormous contribution made by an average woman in rural Sikkim. In fact, one can call her the unsung heroine, who without any glare of publicity, contributes her best to the welfare and progress of the state in particular and country as a whole.

1.5.3 Characteristics of Agricultural Labour

The following are the main characteristics which differentiate agrarian labour from industrial labour (Bhagoliwal, T.N., 1976):-

- (a) There is usually a lack of clear cut employer - employee relationship in agriculture, especially in subsistence farming, as opposed to industry.
- (b) In agriculture there is usually no classification of workers into skilled, semi-skilled and unskilled labour. There are only two types of agricultural labourers employed either for casual work or for regular farm work, on a continuing basis.
- (c) Employment in agriculture is mostly seasonal with varying intensity depending upon regional characteristics and crop pattern. This seasonal activity is followed by a slack period, for which agricultural workers have to seek alternative sources of employment, like road construction and building operations etc.
- (d) Migration is another distinctive feature. In busy season, agricultural labourers migrate from regions where labour is relatively abundant to regions where it is scarce.
- (e) Wage payment in agriculture also show considerable diversity. Payment of wages in kind or partly in cash and partly in kind is quite common. Payment of supplementary wages in the form of perquisites is also made to labourers. Wages for some agricultural operations like harvesting and threshing are paid in kind on basis of piece wage rate; wage structure in agriculture is considerably influenced by traditions and customs.

1.6 The Investigative Study Question

The engagement of women in economic activities in Sikkim is widespread, ranging from the formal to the informal sector; even though a majority of the activities women perform in the informal sector are of “invisible” activities nature, which may not be considered as economic activities. Women’s participation in the formal sector is improved with access to education and therefore as more women get educated and acquire the requisite skills, they are increasingly being engaged in the formal sector with a few of them in senior positions in the government jobs. But, at the same time women’s participation in the formal sector with lower access to education is confined to low profitable jobs. However, considering that women make up majority of the people in the farming sector with low accessibility to the productive resources, it is disheartening to note that their socio-economic condition is pitiable. This fact therefore motivated the researcher to study the present status of females involved in the farming sector in the state of Sikkim and suggest few points that will help women to achieve the best first for them and then also for the state.

Hence the book revolves round the question:-

What is the female farmers view to opt for any entrepreneurial activity to augment their income except agriculture in the state of Sikkim?

2. Theoretical Framework

The literature survey has been subdivided into following five categories:

Gender Wise Participation, Share of Different Sectors in Sikkim, Sericulture. Finally, the section concludes the literature review followed by the research gap.

2.1 Gender-Wise participation

Women play a distinctive role in shaping the rural economic activities and earning a livelihood. India is an agriculture dominated country and most of manual operations like sowing, weeding, transplanting, harvesting, threshing and winnowing and even marketing of agricultural produce are being done by women. Their contribution to the rural economy is enormous. But the role of women in economic and social development has not received due recognition so far in our society. But, efforts are being made by the Government to give due recognition to their participation by making various laws time to time in favour of women.

Contrary to the common perception about women in India, a large percentage of them work (Women of India, 2006, Wikipedia). The National data collection agencies accept the fact that there is a serious under-estimation of women's contribution as workers. However, there are far fewer women in the paid workforce than there are men (Kalyani and Kumar, 2001, Wikipedia). In urban India women have impressive number in the workforce and they are at par with their male counterparts in terms of wages, position at the work place (Singh and Hoge, 2010). In rural India, agriculture and allied industrial sectors employ as much as 89.5% of the total female labour (Asia's women, 2006, Wikipedia). In overall farm production, women's average contribution is estimated at 55% to 66% of the total labour. According to a 1991 World Bank report, women accounted for 94% of total

employment in dairy production in India. Women constitute 51% of the total employed in forest-based small-scale enterprises (Asia's women, 2006, Wikipedia). Agriculture (including allied activities) accounted for 14.6 per cent of the Gross Domestic Product in 2009-10 but its role remains critical as it accounts for about 58.2 per cent of the employment in the country (Economic Survey 2010-11). Apart from being the provider of food and fodder, its importance also stems from the raw materials that it provides to the industry. The prosperity of the rural economy is also closely linked to agriculture and allied activities.

According to population census of India 2001, out of total rural population of 741.7 million, there are about 402.5 million rural workers of which 127.6 million are cultivators, 107.5 million are agricultural labourers and 167.4 million are other farm workers, out of which 6 million are engaged in livestock, forestry and plantations. In other words, pure agricultural workers constitute nearly 58.4 per cent of the total rural workers, of which 31.7 percent are owner cultivators and 26.7 percent are mainly agricultural wage earners (Agriculture Statistics at a Glance, sourced from Registrar General of India, New Delhi 2001). Of the total agricultural labourers, 38.0 per cent were female and 61.9 percent male workers. Also among livestock, forestry and plantation workers, 78.3 percent were male workers and 21.7 percent were female workers. About 99.2 percent of agricultural workers were reported to be unorganized and unprotected. The latest available agricultural census data (Government of India, Agricultural Census Division, and Ministry of Agriculture 2002) also reveal that about 78 percent of operational holdings in the country are marginal and small, having less than 2 hectares. About 13 percent holdings have 2 to 4 hectares and 7.1 per cent have 4 to 10 hectares of land (Haque, 2003).

Table-2.1
Rural Population and Agricultural Workers (in millions)

Year	Total Rural Population	Cultivators	Agricultural Labourers	Other Farm Workers	Rural Workers
2001	741.7	127.6	107.5	167.4	402.5
	(72.22)	(31.7)	(26.7)	(41.6)	(100.0)

Source: Registrar General of India, New Delhi, 2001

Census figures show similar trend as regards increase in women's share of agricultural employment in the post-reform period. Between 1991 and 2001, the agricultural sector saw a decline in rural main workers from 183 million to 171 million, a reduction of 11.7 million male and a mere 0.5 million female workers-taking women's share in the main agricultural workforce from 27 per cent to 29 per cent (Table 2.2). This trend would have been extended into the new millennium. We would know this for sure once the data for 2011 becomes public.

Table 2.2:
Main workers in agriculture, 1991 & 2001 (In millions)

Year	Persons	Male	Female
Cultivators			
1991	110.7	88.5	22.2
2001	103.6	78.3	25.4
Agricultural labourers			
1991	74.6	46.2	28.4
2001	63.5	41.1	22.4
Plantation, livestock, forestry, fishing, and allied activities			
1991	6	4.7	1.3
2001	10.3	6.7	3.6
All agricultural workers			
1991	191.3	139.4	52
2001	177.4	126	51.4

Source: Saxena Naresh C., Women, Land and Agriculture in Rural India, Pp-

11 <http://www.unwomensouthasia.org>

Male migration is affecting traditional social norms too. As men migrate in search of better-paid work, women in rural India are taking over agricultural work in the villages. They face meager wages, long hours, hazardous work and sexual harassment (WTO, 2010). The existence of patriarchy at all levels also intertwines with the work-related problems of women.

2.2 Share of different sectors in Sikkim

(Lama, 2001, pp. 17-18) The structural change, generally reflected in the shift from the primary to the secondary sector, is virtually absent in Sikkim. Industries, in fact, are still a low priority item in Sikkim's plan process. In Sikkim, the structural shift has been slower than in the country as a whole. In 1995–96, India's shares were 30.58 per cent (primary), 25.47 per cent (secondary) and 43.94 per cent (tertiary), while the respective shares for Sikkim were 52 per cent, 13 per cent and 34 per cent.

(Singh, E. Bijoykumar, 2009) It has been noticed that though earlier the structural shift was slower in Sikkim but this paper has analyzed the nature of growth, both at the aggregate level and sectorial level, among the eight states in the North Eastern Region (NER) using NSDP data. It has studied that during the entire period the share of primary sector has declined substantially and that of tertiary has increased. Table 2.3 shows that by 2006-7 except for Manipur tertiary sector has become the predominant sector in all the states. In Manipur due to a spurt in construction activities secondary sector surpassed the tertiary sector. Besides Manipur Arunachal Pradesh is another state with a high share of secondary sector. Except for Arunachal Pradesh and Manipur (in which due to a spurt in construction activities, the contribution of secondary sector surpassed the tertiary sector and dominates in the annual growth rate), the main source of growth in per capita income is tertiary sector. In none of the states in the North-Eastern region is the primary sector the main source of growth though it contributes a significant proportion in Arunachal Pradesh, Assam and Sikkim. It shows the growing role of the non-commodity producing sector in the growth of the economy. The falling share of primary sector in income generation along with the high share in employment indicates falling productivity in this sector. The benefits of growth accrue largely to the small portion of workers in the tertiary sector. This will accentuate the extent of inequality.

The study also shows that in terms of the more encompassing measure of development i.e. human development index, three out of the five states whose HDI have been estimated had HDI higher than that of all India. Thus the income gap has been made up by better performance in education and health. Low rural unemployment rate need not necessarily mean abundant work opportunities in rural areas. It may be attributed to the inability of the rural labour force to remain unemployed for long because of their poverty. This indicates the strength of social capital which needs to be nurtured to attain higher level, by not insisting on mainstreaming.

Only Sikkim registered higher growth rate after the break in tertiary sector which has become more dominant than the primary sector in most of the states. This result further substantiates the irrelevancy of economic policy.

Table-2.3
Share of primary, secondary and tertiary sector in total NSDP (1999-2000 price) (As percentage of National Summary Data Page (NSDP))**

	Primary			Secondary			Tertiary		
	1980-1	1990-1	2006-7	1980-1	1990-1	2006-7	1980-1	1990-1	2006-7
Arunachal Pradesh	46.70	46.84	25.07	16.73	18.28	32.59	36.57	34.88	42.34
Assam	43.01	39.42	34.20	14.99	14.56	15.50	42.00	46.01	50.30
Manipur	43.83	35.93	24.66	18.22	15.72	39.00	37.95	48.34	36.34
Meghalaya	62.16	46.68	32.37	15.48	11.30	15.33	22.36	42.02	52.10
Mizoram*	24.24	16.24		14.15	16.07		61.61	67.69	
Nagaland	40.49	23.32	34.91	7.42	13.73	13.59	52.08	62.95	51.49
Sikkim	39.93	43.62	21.69	14.13	20.13	26.21	45.94	36.25	52.10
Tripura	53.01	46.19	25.57	20.26	5.34	21.05	26.72	48.47	53.38

Source: Singh, E. Bijoykumar (2009)

Note: * terminal year for Mizoram is 2007-8

**The 1999-2000 series has been constructed by splicing the trend values of the values for the period 1980-1 to 1998-99.

• Sectorial Contribution in Sikkim Economy

Table-2.4

Gross State Domestic Product (GSDP) at Factor Cost by Industry of Origin in Sikkim, {(At Current Prices based on 2004-05 Series) (2004-2005 to 2010-2011)}: (Rs. in Lakh)

Source: Central Statistical Organization (CSO) (As on 02.08.2011).

Sector	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11
Agriculture	28520	31600	32757	38201	43106	48998	56998
Forestry & Logging	3744	3194	3247	3243	3798	3948	4102
Fishing	78	90	103	115	125	155	182
Agriculture and Allied	32342	34884	36107	41559	47029	53101	61282
Mining & Quarrying	208	227	235	251	495	564	705
Sub Total of Primary	32550	35111	36342	41810	47524	53665	61987
Manufacturing	6720	7253	8638	10611	11896	12461	13420
Manu-Registered	3373	3780	4537	5501	6507	6656	7079
Manu-Unregistered	3347	3473	4101	5110	5389	5805	6341
Construction	33451	40739	42787	46732	53627	61048	76341
Electricity, Gas and Water Supply	9775	9522	10570	18162	50451	105933	126688
Sub Total of Secondary	49946	57514	61994	75505	115974	179442	216449
Industry	50154	57741	62230	75756	116469	180006	217154
Transport, Storage & Communication	7158	7950	8748	9961	11817	15064	19122
Railways	0	0	0	0	0	0	0
Transport by other Means	4678	5228	5768	6427	7333	8937	10552
Storage	62	65	79	94	113	136	165
Communication	2417	2657	2900	3440	4371	5991	8405
Trade, Hotels and Restaurants	9025	9883	11248	12964	14679	16420	18658
Banking & Insurance	4494	5235	6568	7874	8681	9781	11020
Real Estate, ownership of Dwellings and Business Services	17375	19242	21116	26598	31107	36469	42776
Public Administration	25398	30432	33763	35213	45232	97773	113109
Other Services	27986	33944	36366	40710	47930	65428	82080
Services	91436	106686	117808	133319	159446	240935	286765
State Domestic Product (Rs. in Lakh)	173932	199311	216145	250634	322944	474042	565201

Table-2.5

Gross State Domestic Product (GSDP) at Factor Cost by Industry of Origin in Sikkim, {(At Constant 2004-05 Prices) (2004-2005 to 2010-2011)}:
(Rs. in Lakh)

Sector	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11
Agriculture	28520	29852	29918	31325	33020	35336	37206
Forestry & Logging	3743	3742	3701	3613	3422	3412	3402
Fishing	78	84	89	89	89	94	101
Agriculture and Allied	32342	33677	33708	35027	36531	38842	40709
Mining & Quarrying	208	217	225	239	391	404	458
Sub Total of Primary	32550	33895	33933	35266	36922	39246	41167
Manufacturing	6720	6877	7413	8500	9264	9359	9676
Manu-Registered	3373	3467	3698	4252	4807	4821	5006
Manu-Unregistered	3347	3410	3715	4248	4457	4538	4670
Construction	33451	37923	39338	40706	39350	43047	49319
Electricity, Gas and Water Supply	9775	11042	13039	16523	39951	76064	82530
Sub Total of Secondary	49946	55842	59790	65729	88565	128470	141525
Industry	50154	56059	60015	65969	88956	128874	141983
Transport, Storage & Communication	7158	7982	8856	9915	11296	13305	16199
Railways	0	0	0	0	0	0	0
Transport by other Means	4678	5023	5238	5401	5740	6315	6680
Storage	62	63	75	83	90	98	108
Communication	2417	2895	3542	4431	5466	6892	9411
Trade, Hotels and Restaurants	9025	9234	9356	9831	10312	10899	11353
Banking & Insurance	4494	5639	7261	8794	9236	10458	11842
Real Estate, Ownership of Dwellings and Business Services	17375	17920	18603	21657	24061	25164	26751
Public Administration	25398	28911	31401	32213	35863	60889	63487
Other Services	27986	31539	33203	34436	37266	45880	51894
Services	91436	101225	108680	116846	128034	166595	181526
State Domestic Product (Rs. in Lakh)	173932	190962	202404	217841	253521	334311	364218

Source: Central Statistical Organization (CSO) (As on 02.08.2011).

Gross State Domestic Product (GSDP) at factor cost by industry of origin in Sikkim at constant 2004-05 prices in Table-2.5 shows that during the entire period the share of primary sector has grown only by 26.47%, while growth in secondary sector which has registered a substantial increase of 183.3% even surpassed the tertiary sector

which grew by 98.5% during these years. Secondary sector has become the predominant sector in the state mainly due to a spurt in electricity, gas and water supply activities of the secondary sector.

- **Migration to urban areas involves both “Push” and “Pull” Factors**

The decision to migrate involves both “push” and “pull” factors (Lewis, 1954; and Harris and Todaro, 1970). The Lewis model explains migration as a transfer of labor from labor-surplus sectors (rural areas/ The Subsistence Sector) to labor deficit-sectors (urban areas/The capitalist) until a balance is reached. The Harris-Todaro model on the other hand, postulates that migrants assess various labor market opportunities available in the rural and urban sectors and choose the one that maximizes their expected gains. This model explains some of the deficiencies inherent in the Lewis model such as the rise in rural-urban migration in the context of rising urban unemployment. Overall, some empirical studies found that economic push factors (such as, the lack of rural credit, unemployment, and rural poverty) are most important; while others suggest that economic pull factors (such as, perception of high wages from urban employment) are dominant.

- **Solid waste management is the number one civic problem of Gangtok**

(UDHD, website) Solid Waste Management is one of the most pressing problems of the entire city of Sikkim but, mainly of Gangtok. With most of the people moving towards Gangtok, highly unhygienic conditions prevail in many areas that do not have any regular service of solid waste collection. It is a common practice in such areas to throw the household garbage into the nearest water course (Jhora) where it not only chokes the Jhora, but causes a danger to public health by way of purification, breeding of insects and mosquitoes etc. A problem in improving solid waste

collection has been coverage of inaccessible houses and lack of service in the outlying areas, which are very much urban but not covered under the jurisdiction of notified town area. In view of the difficult topography and many houses being located in inaccessible areas, improving solid waste collection may well be described as the number one civic problem of Gangtok. With the increasing physical growth of the city and development trends, it has become an urgent need to plan for a feasible and sustainable solid waste management, as an integral part of proposed urban development.

- **Use of fire-wood has not changed over a period of time in the State**

Figures in tables 2.6 and 2.7 for households by type of fuel used for cooking confirm the fact that though state government is providing huge amount of subsidy/almost free distribution of LPG connections, still there is widespread use of fire-wood for cooking. As is evident from the tables below, over a period of ten years i.e. from 2001-2011, though the use of LPG for cooking has increased from 19 to 41 percent, but the use of fire-wood for cooking has been decreased only from 65 to 53 percent. The tables below are also revealing that the use of biogas for cooking has not increased.

Table-2.6
Households by Type of Fuel Used for Cooking (2001)

Type of fuel used for cooking:	Total	%	Rural	%	Urban	%
Total	104,738	100.0	91,723	100.0	13,015	100.0
Fire-wood	67,661	64.6	67,189	73.3	472	3.6
Crop residue	827	0.8	802	0.9	25	0.2
Cow dung cake	65	0.1	59	0.1	6	0.0
Coal, lignite, charcoal	76	0.1	61	0.1	15	0.1
Kerosene	15,201	14.5	11,200	12.2	4,001	30.7
LPG	19,718	18.8	11,402	12.4	8,316	63.9
Electricity	521	0.5	519	0.6	2	0.0
Biogas	93	0.1	89	0.1	4	0.0

Any other	3	0.0	3	0.0	-	0.0
No cooking	573	0.5	399	0.4	174	1.3

Source: Table H-10: Census of India 2001, available at http://www.censusindia.gov.in/Census_Data_2001/States_at_glance/State_Links/11_sik.pdf

Table-2.7
Households by Type of Fuel Used for Cooking (2011)

Type of fuel used for cooking:	Total	%	Rural	%	Urban	%
Total	128131	100	92,370	100	35,761	100
Fire-wood	67,310	53	65,418	70.8	1,892	5.2
Crop residue	769	1	685	0.7	84	0.2
Cow dung cake	219	0	198	0.2	21	0.05
Coal, lignite, charcoal	100	0	34	0.03	66	0.1
Kerosene	5,633	4	2,656	2.8	2,977	8.3
LPG	52,871	41	22,438	24.2	30,433	85.1
Electricity	333	0	307	0.3	26	0.07
Biogas	117	0.09	84	0.09	33	0.09
Any other	37	0	28	0.03	9	0.02
No cooking	742	1	522	0.5	220	0.6

Source-HH-10 Series Tables, Census of India 2011, available at http://www.censusindia.gov.in/2011census/hlo/District_Tables/Distt_table/11/HH3410-1100DCRC.pdf

In Sikkim, agriculture is the main economic activity of all the districts in the state. About 30% population of West, 37% of South and 64% each of East and North districts depend upon agriculture. 76% women workers are directly or indirectly engaged in agriculture and allied activities. Among the main workers 71.74% are cultivators, 7.37% are agricultural labourers, 1.58% are engaged in livestock, fishing, forestry, hunting, plantation, orchard and allied activities. So, women are the main participants in agriculture and allied production and they attend all secondary and cumbersome tasks that require more patient, time and devotion.

Actually, the social, economic and cultural conditions of the area determine women's participation in home and farm activities. The nature and extent of women's involvement in agriculture, no doubt, varies greatly from region to region and within a region, their involvement varies among different farming systems, castes, classes

and socio- economic status. But regardless of these variations, there is hardly any activity in agricultural production, except ploughing in which women are not actively involved (Swaminathan, 1985). In some of the farm activities like processing and storage, women predominate so strongly that men workers are numerically insignificant.

However, the Indian Himalayan region (IHR) displays a different picture in land use pattern and its dependency on agricultural land. The Himalayan people have traditionally practiced integrated agriculture, balancing cultivation, agro-forestry, animal husbandry and forestry. Mountain geography and inaccessibility have helped maintain agro-biodiversity; yet commercial agriculture is not as high-yielding and profitable as in the plains. Here forest is the major land use pattern, which covers over 52% of total reporting area followed by wastelands and agricultural land. However, the dependency on its limited arable land is marginally higher in the IHR as cultivators and agricultural labourers together comprise about 59% of total workforce in the region (Nandy and Samal, 2005).

(Indian Himalaya)The urban sprawl is exceedingly high in the state of Mizoram where about 46% of population is urban. Himachal Pradesh and Sikkim are the least urbanized states. Males outnumber females in all areas except for rural areas of Uttar Pradesh Hills and Himachal Pradesh. States in the north-eastern region have achieved a higher level of literacy as compared to those in the central and western Himalaya. Agriculture is the focal activity of hill dweller all through the region. Excepting the state of Tripura, the proportion of women cultivators is more than that of men. In Tripura, more women are reported to be engaged as agriculture laborers and in other occupations.

(Shiva, 1991) In overall farm production, women's average contribution is estimated at 55% to 66% of the total labour with percentages, much higher in certain regions. In the Indian Himalayas a pair of bullocks works 1064 hours, a man 1212 hours and a woman 3485 hours in a year on one hectare farm, a figure that illustrates women's significant contribution to agricultural production. (Sujaya, C.P. 2001) is also of the same opinion.

(Lama, 2001, pp.33-34) The State of Sikkim seems to have recorded several achievements, reflected also in the level of the HDI and GDI, in the social sectors. In Sikkim, women constitute nearly 47 per cent of the total population. Their social position in the State seems to be better than that in the rest of the country. Women also play a major role in trading activities, which allows them to participate in decision-making far more than in most other States in India. In contrast to the unfavourable sex ratio in the population as a whole, the number of women in government employment is greater than that of men. The role of women's empowerment for a just society was highlighted in the Beijing Conference (1995). The status of women in Sikkim—their economic contribution, socio-cultural autonomy, authority, involvement in the decision-making process within the household—varies across communities. The practice of polyandry among tribal communities could be one of the variables explaining the higher value attached to women. Similarly, local religious practice also plays a role in influencing the status of women (Dhamala, 1985).

(Sadangi et al., 1996)The study found that in rural areas the women belonging to higher caste families are socio-economically better and possess some landed properties. Due to their higher social status, they do not like to engage themselves in difficult field work or in the fields of lower caste people.

(Rahman et. al. 2009) In Sikkim, though men and women do almost all works from land preparation to seed storage. But at the same time, their role depend more on the family situation than on gender or ethnicity. In a family with more male members, male works in the fields, whereas in families with fewer men, women work equally with men. Purchasing of seed is generally done by men. Men do the ploughing while men and women do the hoeing and digging. Sowing, planting, manure application, harvesting is done by both men and women. Mulching is done mostly by men, although women help as when required. Weeding is done by women. In Sikkim, mother rhizome extraction is done by women but its sale is looked after by men. In Meghalaya, Mizoram and Nagaland, women play a significant role in retail selling of Ginger.

Some historians believe that it was woman who first domesticated crop plants and thereby initiated the art and science of farming. While men went out hunting in search of food, women started gathering seeds from the native flora and began cultivating those of interest from the point of view of food, feed, fodder, fiber and fuel (Prasad and Singh 1992). Women have protected the health of the soil through organic recycling and promoted crop security through the maintenance of varietal diversity and genetic resistance. Therefore, without the total intellectual and physical participation of women, it will not be possible to popularize alternative systems of land management to shifting cultivation, arrest gene and soil erosion, and promote the care of the soil and the health of economic plants and farm animals.

2.3 Sericulture

Silk is a way of life in India. Over thousands of years, it has become an inseparable part of Indian culture and tradition. No ritual is complete without silk being used as a wear in some form or the other and is also called as The Queen of Textiles. It is

characterized by exquisite qualities like the natural sheen, inherent affinity for dyes, vibrant colours, high absorbance, light weight, resilience and excellent drape, etc. Sericulture and Silk Textiles Industry is one of the major sub-sectors comprising the textiles sector. Sericulture is an agro-based cottage industry. Sericulture refers to the mass scale rearing of silk producing organisms in order to obtain silk. Sericulture is an agro-based labour intensive industry. The major activities involved in a sericulture industry are:

- a) Cultivation of silkworm food plants
- b) Rearing of silkworms for the production of raw silk
- c) Reeling the cocoons for unwinding the silk filament and
- d) Other post-cocoon processes such as twisting, dyeing, weaving, printing and finishing.

Sericulture is one of the most labour intensive sectors, combining activities of both agriculture (sericulture) and industry. India is ranked as the second major raw silk producer in the world. It is this position along with its immense employment potential that makes sericulture and silk, indispensable in the Indian textile map.

Sericulture is one of the rural based agro industries with global reach. While providing sustainable income and employment opportunities to the rural poor who are the main practitioners, silk production activity fetches annual export earnings of more than US\$600 million (http://www.seri.ap.gov.in/poten_part_women_seri.pdf). Some unique features of the silk sector are its rural nature, agro based, ecologically and economically sustainable activity for the poor, small and marginal farmers, agriculture labour and women in particular. Many studies indicated that 60% of the activities in the pre-cocoon and post-cocoon sectors are carried out by women.

2.3.1 Women in Sericulture

Sericulture is a small scale industry which is an important entrepreneur for rural families. The role of women as agricultural labourers in mulberry cultivation is important because mulberry garden requires labour from the beginning for pruning, weeding, application of farm yard manure, fertilizers and other jobs. An acre of land optimally requires 10 labourers out of which 7 would be women (Rani Usha J., 2007). The main work involves plucking of leaves for feeding the silkworms. At the rearing houses the activities that are performed by women are as follows:

- a) Cleaning the rearing house, before the silkworm are raised.
- b) Getting the trays ready for further extension of bed.
- c) Feeding the worms after the 3rd instar which has to be done 4-5 times per day.
- d) Changing the bed in each of the trays. (At least 56-60 trays will be there, by the time they reach the 5th instar)
- e) Placing the worms in the mount ages i.e. around 120 of them.
- f) Harvesting the cocoon.
- g) Cleaning the cocoon and removal of floss grading.
- h) Marketing of cocoon though very few women takes up this job, as it takes time in the market.

When the crop of rearing is over, women have to clean and get the trays smeared with cow dung and get ready for the next rearing.

(Chelladundi, 1999) in his study on 'Employment generation in Sericulture' concluded that sericulture provides two types of employment

- a) Direct – mulberry cultivation and cocoon rearing
- b) Indirect –Reeling, twisting, warping, dyeing and weaving.

The role of sericulture in generating employment and income is discussed in a very clear-cut manner. The criterion of employment and income in silk reeling units is also dealt with (Radha Krishna et al. 2000) in their study on ‘Silk and Milk- an economic package for rural upliftment’ explained that an acre of irrigated mulberry generates as much as one lakh rupees per year through transaction of cocoons and provide full employment to a minimum of 5 men throughout the year.

Silk is a high value but low volume product accounting for only 0.2 % of world's total textile production. It churns out value added products of economic importance.

2.3.2 Types of silk

India holds the monopoly on producing the Muga silk. It is the only one cash crop in agriculture sector that gives returns within 30 days. Sericulture emerged as an important economic activity, becoming increasingly popular in several parts of the country, because of its short gestation period, quick recycling of resources. It suits very well to all types of farmers and exceptionally for marginal and small land holders as it offers rich opportunities for enhancement of income and creates own family employment round the year (http://business.gov.in/agriculture/current_scenario_sericulture.php).

There are five major types of silk of commercial importance, obtained from different species of silkworms. The five varieties of silk may be divided into two broad categories:-

i.) Mulberry Silk

ii.) Vanya Silk or Non-Mulberry Silk (all other varieties of silk fall in this category)

i) Mulberry Silk

It comes from the silkworm, *Bombyx mori* L. which solely feeds on the leaves of mulberry plant. The bulk of the commercial silk produced in the world comes from this variety. In India, the major mulberry silk producing States are Karnataka, Andhra Pradesh, West Bengal, Tamil Nadu and Jammu and Kashmir which together accounts for 92 % of country's total mulberry raw silk production.

- **Climate**

Mulberry can be grown up to 800 m MSL. For the optimum growth of mulberry and good sprouting of the buds, the mean atmospheric temperature should be in the range of 13o C to 37.70 C. The ideal temperature should be between 24 and 28o C with relative humidity of 65 to 80 percent and sun shine duration of 5 to 12 hours per day. Mulberry can be grown in a rainfall range of 600mm to 2500mm. Under low rainfall conditions, the growth is limited and requires supplemental irrigation. On an average, 50mm once in 10 days is considered ideal for mulberry.

- **Soil**

Slightly acidic soils (6.2 to 6.8 Phosphorus) free from injurious salts are ideal for good growth of mulberry plant. Saline and alkaline soils are not preferred.

ii.) **Temperate Tasar Silk:**

It is generated by the silkworm, *Antheraea mylitta* which mainly thrive on the food plants Asan and Arjun. Tasar (Tussah) is a copperish colour, coarse silk mainly used for furnishings and interiors. In India, the major tasar silk producing States are Jharkhand, Chhattisgarh and Orissa, Maharashtra, West Bengal and Andhra Pradesh.

a) **Tropical Tasar silk or Oak Tasar Silk:**

It is a finer variety of tasar generated by the silkworm, *Antheraea proylei* J. which feeds on natural food plants of oak. In India, it is mainly produced in the sub-Himalayan belt of India covering the States of Manipur, Himachal Pradesh, Uttar Pradesh, Assam, Meghalaya and Jammu and Kashmir.

b) **Muga Silk:**

It is a golden yellow colour silk obtained from semi-domesticated multivoltine silkworm, *Antheraea assamensis*. These silkworms feed on the aromatic leaves of Som and Soalu plants. Muga Silk is the pride of Assam and is an integral part of the tradition and culture of the State.

c) **Eri Silk (or Endi or Errandi):**

It is the product of a domesticated silkworm, *Philosamia ricini* that feeds mainly on castor leaves. It is a multivoltine silk spun from open-ended cocoons, unlike other varieties of silk. In India, this culture is practiced mainly in the North-Eastern States including Assam. It is also found in Bihar, West Bengal and Orissa. Sericulture is a household activity practiced mainly for protein rich pupae, a delicacy for the tribal.

Resultantly, the eri cocoons are open-mouthed and are spun. The silk is used indigenously for preparation of chaddars (wraps) for own use by these tribals.

Geographically, Asia is the main producer of silk in the world and produces over 95 % of the total global output. But, bulk of it is produced in China, India, Japan, Brazil and Korea. India is ranked as the second major raw silk producer in the world. It contributes about 18% to the total world raw silk production.

Among the varieties of silk produced, mulberry silk accounts for 89.45%, followed by eri, tasar and muga at 8.04%, 1.89 and 0.62%, respectively. About 40-45% of silk produced is from charka and about 40-45% is from cottage basins and the rest 10% silk is from multi-end reeling. It is this position along with its immense employment potential that makes sericulture and silk, indispensable in the Indian textile map. It is practiced in about 53,814 villages all over the country. It provides employment to about 6 million people, most of them being small and marginal farmers, or tiny and household industry mainly in rural areas. (http://business.gov.in/agriculture/state_departments_sericulture.php#top).

Sericulture is an eco-friendly agro-based labour intensive rural cottage industry providing subsidiary employment and supplementing the income of rural farmers especially the economically weaker section of the society.

In the development of sericulture industry, the role of State Governments has customarily been the expansion of sericulture activity and provision of farmer level extension as well as other support services, including credit facilitation.

India being blessed with prevalence of favourable climatic conditions, mulberry is cultivated in almost all states. But, traditionally sericulture is practiced in Karnataka,

Andhra Pradesh, Tamil Nadu, West Bengal and Jammu and Kashmir, which together accounts for 92 % of country's total mulberry raw silk production in the country. Muga is twined with the culture of Assam and has the monopoly. In the recent years, muga rearing is extended to other states like Mizoram, Arunachal Pradesh, Manipur, Uttarakhand, Andhra Pradesh, and West Bengal. Now, as a result of growing realization, sericulture is gaining ground in non-traditional areas too. Sericulture and Weaving in Meghalaya are the two most important cottage based, eco-friendly industries in the rural areas. The thrust area under sericulture sector is to boost up cocoon and silk production by development of systematic and economic plantation at sericulture farmers level so as to enhance the productivity per unit area. In-service training of technical personnel and training for the educated unemployed youth for self-employment are also provided. Andhra Pradesh produces all the four popular varieties of Silk worm cocoons namely Mulberry, Tasar, Eri and Muga. In Tamilnadu, the Handlooms, Handicrafts, Textiles and Khadi Department was formed in 1985. It is also concerned with the development of Sericulture in the State for the welfare of weavers / artisans.

(http://business.gov.in/agriculture/policies_schemes_sericulture.php)

2.3.3 Policies and Schemes

There are several centrally sponsored schemes for promotion and development of sericulture sector, through which Government of India has been undertaking different activities like:

- 1) Creation of sericulture related infrastructure;
- 2) Development of nurseries and farms;
- 3) Expanding plantation areas;
- 4) Providing technical know-how to the rearers in production and marketing of cocoons;
- 5) Skill up-gradation and training programme, etc.

The Central Silk Board has been implementing the catalytic development programme for development of sericulture in collaboration with the State Governments and also through the cluster approach/SGSY programme of the Ministry of Rural Development. It aims to promote adoption of improved technology practices in various activities like host plantation, seed production, rearing of silkworm, reeling and twisting, weaving, printing and dyeing for enhancement of production and productivity as well as up gradation of the quality of silk.

The basic objectives of the programme are technology absorption, investment generation, productivity improvement and employment generation. Supports is also given in the operations ranging from food plant cultivation to marketing of products in mulberry, tasar, eri, muga silk and producing quality cocoons and raw silk in the silk producing States. For this, financial assistance with the subsidy/assistance is also to be provided to the beneficiaries by both Silk Board and the concerned State Government.

Support and incentives are provided mainly to small and marginal farmers and small entrepreneurs, under both on-farm and off-farm activities, in mulberry and non-mulberry sectors. The Central Silk Board has been implementing various schemes/projects for the development of sericulture by monitoring the flow of funds. It also plays a pivotal role in advising the Government on matters related to the silk industry.

2.3.4 Some more valuable information in mulberry cultivation and sericulture-

These are some of the answers for the queries of the problems faced while carrying out sericulture with mulberry plantation in Pampore, which can prove to be very helpful, whosoever will be facing problem while carrying out such activity.

Tree plantation of mulberry is to be carried out in the month of July (rainy season). However, under temperate conditions, it is done in the month of March and October. For mulberry plantation the soil should be slightly acidic (pH 6.2 to 6.8). Make bundle of 20 kilograms and preserve in vertical position as moisture loss in such position is minimum. Mulberry shoots are to be transported during cooler hours of the day. If they are to be transported to long distance and takes more than 30 minutes, they should be covered with wet gunny cloth, polythene sheet to reduce moisture loss from the leaf. However, for qualitative production of leaves the recommended package of practices, use of integrated nutrient management and integrated disease, insect and pest management is to be followed. So many intercrops can be grown with mulberry. The studies conducted at CSR and TI, Pampore have revealed that crops like saffron, peas, and beans can be cultivated as intercrop with mulberry without affecting the leaf quality and yield. The different high yielding mulberry varieties that can be grown as tree under Kashmir conditions are Goshorami, KNG and TR-10 to get quality foliage besides high yield. The most preferable season for planting mulberry saplings in Kashmir is 1st week of March and October-November. Sericulture department of the state or its subunits in the particular area can be contacted. Serichlor' is used to disinfect the rearing houses. However, as it is carried out by the Government agencies, farmers will have not to bother. The quantity of solution required for disinfection of rearing houses is @ 2.0 litres / sq. meter or 140 ml / sq. ft. the hygienic measures which are required to be followed during rearing are - avoid borrowing rearing appliances, do not use appliances without disinfections, restrict entry of persons into rearing house, persons entering the rearing house must disinfect feet and hands before entering, sprinkle 5% bleaching powder in slaked lime at the passage of entrance, wipe the floor after each bed cleaning. Bed disinfectants used for prevention of diseases are RKO, Resham Jyothi, Vijetha, Ankush etc. Vijetha as bed disinfectant was tested and was found to give best result over others.

There should be cross ventilation as higher % of CO₂ in the rearing house is injurious to health of larvae. Spinning larvae can be identified by these features - these larvae feed less, become soft, litter becomes light brown coloured which can be crushed with fingers, skin becomes gradually transparent, crawl here and there in search of space for spinning, larvae tend to move to darker areas.(
<http://www.csb.gov.in/faq/csrti-pampore/>)

In reality, it is an occupation by women and for women, because women form more than 60% of the workforce and 80% of silk is consumed by them. The nature of work involved in the sericulture industry such as harvesting of leaves, rearing of silkworm, spinning or reeling of silk yarn and weaving are carried out by women. Keeping in mind the major role played by the women in the industry, exhaustive training programmes have been organized for them. Till date, about 2500 farm women have been trained from different States like Karnataka, Andhra Pradesh, Tamil Nadu, Kerala and Maharashtra. Important disciplines which boosts the skill and income like Integrated Nutrient and Disease Management, Young Age silkworm Rearing, Composite Rearing, Integrated Pest and Disease Management, Silkworm Seed Production, Value Addition to By-products of Sericulture Industry and Drudgery reduction through ergonomically sound appliances are intensively covered during the training.

Due to continuous R and D output in sericulture, several technologies have been evolved and due to this, production cost of cocoon has been reduced considerably. Recently, with the enforcement of these new research findings both in mulberry cultivation and silkworm handling has become more economical, the silk industry is now being practiced as a main profession and as a major cash crop of the country in many States (http://business.gov.in/agriculture/future_prospects_sericulture.php).

2.3.5 Hindrances of Sericulture

The Indian sericulture industry is currently facing several problems which have restricted full utilization of its potential. Some of the major problems are given below.

- **Produce good quality bivoltine silk:**

Indian silk yarn is of poor quality, which not only affects our competitiveness in the world market, but has also resulted in a preference for imported yarn in the domestic market. Though the Indian breeds have the potential to produce the good quality of bivoltine silk, the problem arises due to lack of:

- a) Sufficient thrust on the adoption of improved technologies;
- b) Strict disease control measures;
- c) Quality leaf due to insufficient inputs to mulberry garden;
- d) Appropriate montages;
- e) Grading system for cocoons;
- f) Quality-based pricing system as well as use of young age silkworms.

Bivoltine yarn is sturdier and is used by the power loom industry. But only 5% of the silk produced in India is bivoltine because its production requires much more attention and resources. It also yields just two crops in a year, as against the yield of four to six crops by multivoltine silk. Even the farmers do not have any incentive to switch to bivoltine silk yarn production because the difference between the selling price of bivoltine and multivoltine silk is not much.

- **The other factors responsible for it are:**

- a) Insufficient adoption and proliferation of technology packages developed through Research and Development efforts;
- b) No effort to increase the area under mulberry;
- c) Fragmented and ad hoc approach;

- d) Non-involvement of private partners in a big way in seed production; farming and reeling;
- e) Non-penetration of the schemes;
- f) Improper forward and backward linkages; and
- g) Dumping of cheap Chinese raw silk and fabric.

It is necessary to encourage farmers to move from production of multivoltine silk to bivoltine silk through proper incentives. At the same time it must be ensured that adequate amount of multivoltine is available for the handloom sector to continue production. Its production in the country continues to be unsteady and fluctuates from year to year. With its uniqueness, non-mulberry silk production in India has a great potential for value added exports.

- **Need for quality based pricing:**

Reeling sector is an input-dependent activity and its operations are influenced heavily by three factors, namely, cocoon quality, cocoon price, and cocoon supply. But due to absence of quality-based price fixation, there has been very little quality control.

Given the fact that the scope for enhancing the production of silk in the country by expanding the cultivable area is limited, hence, vertical expansion through productivity increase by using advanced technology and skilled man-power is the only option. In fact, emergence of new sericulture technology has not only reduced the production risks (drudgery) but has also increased the potential cocoon yield/unit area, relative to the traditional technology.

2.4 Conclusion

In this section we have surveyed the literature on females participating in farming sector. Studies covered under it, all point to the conclusion that in the developing

countries, the sociological condition of the females in farming sector in the selected areas is same. It has also been found that in the hilly areas of Sikkim though agriculture is the leading economic sector with majority of its land holdings is small, but secondary and tertiary sectors are growing by leaps and bounds thereby workforce is getting lured towards it. Women who are the principal players in the drudgery prone agriculture activities do not reap much profit by employing themselves in it. Literature review has found that by gainfully employing themselves in the allied agriculture sectors like sericulture, floriculture etc. where female's services are required more, female farmers can improve their socio economic condition by generating much income through their small land holdings.

2.5 Study Gap

Our literature review finds a gap that female participation in farming sector has not been studied in Sikkim, though plenty of research is found in other parts of the India as well as in other countries the world over. This gap is mainly attributable to the following reasons:-

- **Social science research in the state of Sikkim is inadequate**

The place researcher selected for study is particularly important because social science research in the state of Sikkim is inadequate despite several incentives provided by the state. There are many reasons for this - including the fact that English education started off late and there are no secondary and senior secondary boards in Sikkim and the State is fully dependent on Central Boards. Very few scholars from North Bengal University and other universities have undertaken research on the socio-political and economic aspects of Sikkimese women. Though a few reports

based on the Sikkim census data is found, but, published materials available in the market are based on visits to Gangtok but are not based on field-work analysis.

- **Availability of unreliable data of the North Eastern region before the launching of economic journal “NEDFi Databank Quarterly” on July 2002**

Data on the North Eastern region, though available, is mostly scattered and often proves difficult to gather. Moreover, much of such data collected is often unreliable. Non-availability of reliable and authentic data on the region often hampers in the making of sound investment decisions by entrepreneurs and business persons, policy directions by policy makers, research by students & others. Now “NEDFi Databank Quarterly” journal has made the research task easy by providing the reliable data of the region.

This research will therefore go some way in filling the major research gaps in sociological studies of participation of females in Sikkim farming sector, especially as it relates to the social relations within the agriculture networks and impacts on farmers ‘livelihoods’. This piece of work will be useful for female farmers, development organizations, donors and policy makers, in formulating the development of effective initiatives and policies to support the empowerment of females participating in Sikkim agriculture in particular and females participating in agriculture at any other place in general, in an organic way.

3. Methodology

3.1 The Exploratory Research Question

What is the female farmers view to opt for any entrepreneurial activity to augment their income except agriculture in the state of Sikkim?

3.2 Objectives of the Study

The main objective of the work is to assess the female farmers view to opt for any entrepreneurial activity.

3.3 Scope of the Study

The study has assessed the female farmers view to opt for any entrepreneurial activity to augment their income except agriculture.

3.4 Delimitations of the Study

Married females living in rural areas who do not participate in farm/animal activities are excluded from the study. Also the male farmers of the rural Sikkim are not the part of the study.

3.5 The Hypotheses

To achieve the objective of the research it is expected that following hypotheses may be accepted or rejected:

Below are given the few hypotheses:-

3.5.1 For female farmers views about the income they get from their farm-

Hypothesis Statement – More farming females of rural area are satisfied with the income they get from their farm.

Ho –no more number of sample female farmers are satisfied with the income they get from their farm.

3.5.2 For female farmers views about doing anything except agriculture-

Hypothesis Statement – More farming females of rural area would like to do anything except agriculture.

Ho – no more number of sample female farmers would like to do anything except agriculture.

3.5.3 For female farmers views to opt for any entrepreneurial activity-

Hypothesis Statement – More farming females of rural area would like to opt for any entrepreneurial activity.

Ho –no more number of sample female farmers would like to opt for any entrepreneurial activity.

3.6 Nature of the Study

This study is empirical by nature, as the researcher is concerned to develop principles by arriving at generalizations and an aid to solve problems by improving knowledge, understanding skill and ability to make decisions.

3.7 Research design

Exploratory studies are necessary when some facts are known but more information is needed for developing a viable theoretical framework. Therefore, after going through literature survey and the problem in detail, researcher thought that it was most feasible to use exploratory research design for the study. To a certain extent design has also been built around descriptive research, as the work required describing certain behaviours, strategies, beliefs etc. This research design has helped the researcher in enhancing familiarity with the problem under investigation and to clarify the concepts. It will help in finding out the new hypotheses that could be pursued by future researchers.

3.8 Universe or Population

The universe or population for the study consists of total number of married females in rural areas who are employed in farming in the state of Sikkim. This forms the pivotal point of the present research.

3.9 Sampling method for selected area of study

Multi-stage stratified random sampling technique of probability method is used to select the population from circles, revenue blocks and villages, then a combination of Judgment and Convenience sampling techniques of non-probability methods is decided upon for this study. Non-probability methods are of three types, namely Judgment sampling, Convenience sampling and Quota sampling. The state has only four districts; so, all of them have been taken for the study. Initially, under the multistage stratified random sampling technique- a selection of a tentative list of circles and revenue blocks from all the four districts was made followed by a

selection of villages to be visited at the second and a selection of respondents at the final stage. A final list of the respondents from different farm households was prepared based on convenience and their accessibility to the researcher by stratified random sampling.

3.10 Sample size

Rural areas from all 4 districts of Sikkim were selected. As is clear from the table 3.1 below, though North district contains maximum area of the State i.e. almost 60%, but it holds only 7-8% of the population. On the contrary East district contains only 13% area of the State, but it holds maximum i.e. 45% of the population. So, for this study, maximum no. of females for data collection is from East & minimum are from North. Here, the size of the sampling female farmers from each district is neither proportional to the minimum size of the sampling female farmers of the district nor in the same ratio as is the percentage ratio of each district to the total population of the state. But the sample size of each district is just an indicative of the reason of taking maximum/minimum sampling units from that area.

Table 3.1:- Selection of Sample Size

District/ State	Total area (sq.km)	%of total area	Population Concentration	% of total Population	Total no. of circle	Total no. of circles sampled	No.of female sample farmers
East	954	13.5	2,45,040	45.3	21	06	80
West	1166	16.5	1,23,256	22.8	21	06	60
North	4226	59.5	41,030	7.6	07	04	30
South	750	10.5	1,31,525	24.3	23	08	60
Sikkim	7096	100	5,40,851	100	72	24	230

Source- figures extracted from census 2001.

A data collected from a total of 24 circles from all the four districts in Sikkim has been analysed. The district wise i.e. (East, West, North & South) distribution of circles selected is 6, 6, 4 & 8 respectively. A total of 80 females of farming community from East, 30 from North and 60 each from West & South districts have been interviewed. Data for 115 samples (50% of 230), was collected by the

researcher herself, while for rest of 115 samples (40, 30, 15 & 30 from East, West, North & South respectively), was collected with the active help and participation of all the village heads. Data thus collected from 230 married females in rural areas in the state of Sikkim, employed in farming sector has become the basis of the Primary Data analysis in this Study (Dwivedy Nidhi, 2013)¹.

3.11 Data collection and analysis

In order to collect qualitative data, three group discussion sessions were arranged separately in three villages (Syari, Sichey and Rawtey rumtek); each group contained 10 participants. During these group sessions, several open-ended questions were asked from the respondents in order to collect deeper information about their accessibility to resources and their participation in different farms and the related activities along with many hidden facts and factors. Based on this information, the research instrument i.e. questionnaire containing dichotomous, multiple choice and open end questions was designed and a pre-test was conducted with 18 respondents for its necessary modification. It was then translated into Nepali also for the convenience of the farm population. Primary data was collected by researcher by visiting the farming females of rural area in Sikkim, using questionnaires. The primary data was collected between March to September 2011 from all districts of Sikkim.

Books, journals, reports and internet documents were used as secondary sources of data supporting or supplementing the empirical findings of the study.

- **Data analysis**

Data has been analysed using the Statistical Package for the Social Science (SPSS) and some descriptive statistics, such as percentage, mean, standard deviation (SD) were used to interpret the data.

There is only one sample in the study. Ordinal and nominal level data can be analysed using parametric statistics; therefore One-Sample t-test for inferential interpretation of the data has been run to understand the nature of relation between the variables. For the inferences of the hypotheses, Information from literature survey is taken to support some assumptions.

The column labelled Sig. (2-tailed) displays a probability from the t distribution with 229 degrees of freedom df, calculated as (n-1). The value listed is the probability of obtaining an absolute value greater than or equal to the observed t statistic, if the difference between the sample mean and the test value is purely random. The Mean Difference is obtained by subtracting the test value, from each sample mean.

The 95% Confidence Interval of the Difference provides an estimate of the boundaries between which the true mean difference lies in 95% of all possible random samples of 230 females. At this level if value of 't' is less than 1.96 and is also negative, then our null hypothesis is accepted else alternate hypothesis is accepted.

3.12 Sections of the Book are as under:

Section I : Introduction

Section II : Theoretical Framework

Section III : Methodology

Section IV : Result Analysis and Findings

Section V : Conclusion, discussion and recommendations

3.13 Need of the study

- **To highlight the invisible contribution of rural females so that it gets counted**

The researcher found in the literature review that in rural India though the contribution of females in farm/animal and the related activities is enormous, but still invisible and does not get counted for. Due to this they have to face several challenges. This in turn limits the role of women to drudgery prone, unskilled activities forcing them to have poor socio-economic condition. The researcher also found in the literature review that rural women throughout the developing nations are having almost the same state of participation as well as the socio economic condition. Hence, in order of study in detail the socio economic condition of rural women and the activities they perform, the researcher has selected one of the North-Eastern States of India i.e. Sikkim. After analysing their present socio-economic state, the researcher has tried to make a fair endeavour to suggest some points for the upliftment of the socio economic condition of the women. The researcher also believes that the suggestions given for them are universal in improving the socio-economic condition of rural women facing such problems.

4. Analytical Framework

In the preceding section objectives, scope, delimitations, hypotheses, research design, universe, sampling frame, sampling method, sample size, sources of data, data collection methods, methods of data analysis for hypothesis testing, section wise plan for thesis and need of the study have been discussed. In the present section we will be discussing about the analysis and the findings of the data collected according to the methodology discussed in the section III.

Result Analysis and Findings section has been subdivided into following categories:

- (1) Views about the Income they get from their Farm (A)
- (2) Views about doing anything except agriculture (B)
- (3) Views to opt for any entrepreneurial activity (C)
- (4) Agriculture Practices in Sikkim
- (5) Integrated Low Investment Rain-Water Harvesting

• Assessment of female farmer's views

A, B and C in the table 4.1 and table 4.2 represent - Feeling about the income they get from their farm (A), Doing anything except agriculture (B) and Views to opt for any entrepreneurial activity (C). Degree of answer for (A), (B) and (C) in tables-4.3, 4.4 and table-4.6 ranges from 1 to 10. 1 indicates strongly negative and 10 indicate strongly positive feeling. Whereas, degree level 5 indicates moderate feeling for the question.

Table-4.1 -One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
Q.6 A	230	4.47	1.725	.114
Q.6 B	230	7.57	2.451	.162
Q.6 C	230	8.12	2.064	.136

Table-4.2-One-Sample Test						
	Test Value = 5					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Q.6 A	-4.702	229	.000	-.535	-.76	-.31
Q.6 B	15.923	229	.000	2.574	2.26	2.89
Q.6 C	22.903	229	.000	3.117	2.85	3.39

4.1 Inclination of the views for the income they get from their farm (A)

- Parameter details:**

Statistics for Views about the income female farmers get from their farm (A), is shown in the Table-4.1 above. From the table we find that there are 230 valid scores and value of mean for it is 4.47. Standard deviation is 1.725 and standard error of mean is 0.114.

- Extent of inclination for their views**

The percentage column of the table - 4.3 as well as figure-4.1 below give the clearer picture of the data by showing that 9% of the respondent female farmers strongly feel negative (unhappy) about the income they get from their farm. About 28% of them rated 5 for their view and 26% rated it 4. Only 14% rated their view for this question as 6. Only 1% of them strongly feel positive (happy) about the income female farmers get from their farm. Since 76% of the respondents rated their view for this question up to 5. This shows the inclination of the view towards negative side. So, we can say that most of the female farmers are unhappy with the income they get from their farm.

Table – 4.3 - Degree of answer for the View about the income female farmers get from their farm-Q.6A					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strong Negative 1	21	9.1	9.1	9.1
	2	10	4.3	4.3	13.5
	3	19	8.3	8.3	21.7
	4	60	26.1	26.1	47.8
	5	65	28.3	28.3	76.1
	6	33	14.3	14.3	90.4
	7	12	5.2	5.2	95.7
	8	8	3.5	3.5	99.1
	9	2	.9	.9	100.0
	Total	230	100.0	100.0	

Source: Field Survey

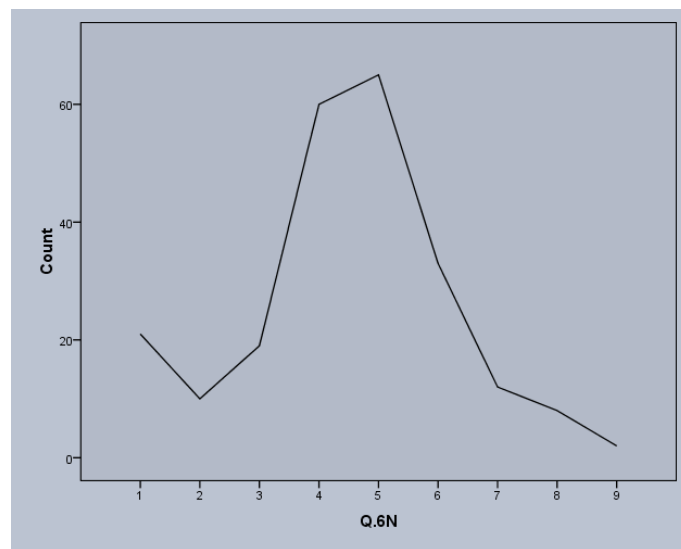


Figure-4.1, Inclination of the views for the farm income

• Inferential analysis

From the table 4.2, we find that value of 't' for views about the income female farmers get from their farm is -4.702, which is less than 1.96. This is further confirmed by significance level which is zero and also by confidence intervals, both limits of which lie entirely below 0.0. Thus there are valid reasons for null hypothesis to be accepted for it, which says that no more number of sample female farmers are satisfied with the income they get from their farm.

4.2 Views about doing anything except agriculture (B)

- Parameter Details:**

Statistics for doing anything except agriculture (B) of Females Farmers is shown in the Table-4.1 above. From the table we find that there are 230 valid scores and a value of mean it is 7.57. Standard deviation is 2.451 and standard error of mean 0.162.

- Extent of feeling for doing anything except agriculture**

Table-4.4 shows that 02% of the respondents strongly feel negative for doing anything except agriculture. About 12% of them rated 5 for their view and 06% rated it 4. 10% rated their view for this question as 6. 30% of them strongly feel positive for doing anything except agriculture. Since 75% of the respondents rated their view for this question above 5. This shows the inclination of the view towards positive side. So, we can say that most of the female farmers are interested for doing anything except agriculture. Things become clearer with Pie diagram in figure-4.2 given below which shows the dominance of strongly positive view of the women in it.

Table -4.4-Degree of answer for doing anything except agriculture-Q.6 B					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strong Negative				
	1	5	2.2	2.2	2.2
	2	6	2.6	2.6	4.8
	3	3	1.3	1.3	6.1
	4	13	5.7	5.7	11.7
	5	28	12.2	12.2	23.9
	6	23	10.0	10.0	33.9
	7	12	5.2	5.2	39.1
	8	26	11.3	11.3	50.4
	9	46	20.0	20.0	70.4
	Strong Positive				
	10	68	29.6	29.6	100.0
	Total	230	100.0	100.0	

Source: Field Survey

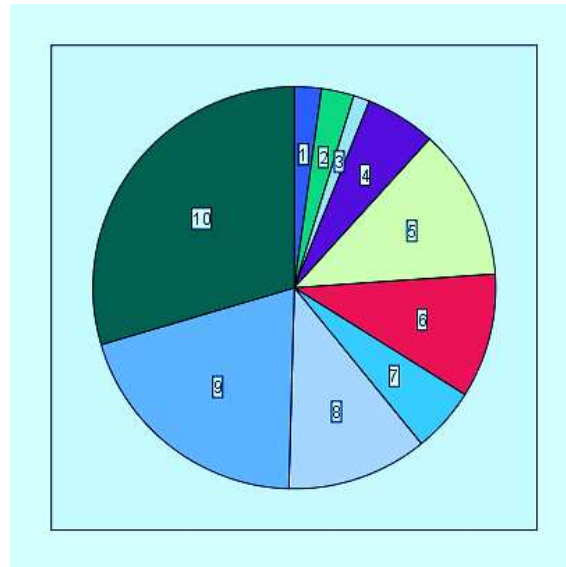


Figure-4.2, Pie diagram showing the views for doing anything except agriculture

- **Inferential analysis for views about doing anything except agriculture**

From the table 4.2 we find that confidence intervals lie entirely above 0.0 and also it is positive. The value of 't' for this is 15.923, which is higher than 1.96. This is further confirmed by significance level which is 0 and also by confidence intervals, both limits of which lie entirely above 0.0 for it. We can safely say that null hypothesis for this view is rejected and thus alternate hypothesis for it is accepted, which says that more number of sample female farmers would like to do anything except agriculture.

4.3 **Inclination of the views to opt for any entrepreneurial activity (C)**

- **Parameter details:**

Statistics for views to opt for any entrepreneurial activity (C), of Females Farmers is shown in the Table-4.1 above. From the table we find that there are 230 valid scores and value of mean for it is 8.12. Standard deviation is 2.064 and standard error of mean is 0.136.

- **Extent of the inclination for this views**

The percentage column of the table - 4.5 as well as figure of the table -4.3 give the clearer picture of the data by showing that only 02% of the respondents strongly feel negative to opt for any entrepreneurial activity (C). 05% of them rated 5 for their view and 05% rated it 4. 06% rated their view for this question as 6. 33% of them strongly feel positive to opt for any entrepreneurial activity (C). Since only 13% of the respondents rated their view for this question up to 5. This shows the inclination of the view towards positive side. So, we can say that most of the female farmers do feel to opt for any entrepreneurial activity (C).

Table -4.5-Degree of answer for their views to opt for any entrepreneurial activity-Q.6 C					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strong Negative 1	4	1.7	1.7	1.7
	2	2	.9	.9	2.6
	3	1	.4	.4	3.0
	4	11	4.8	4.8	7.8
	5	11	4.8	4.8	12.6
	6	13	5.7	5.7	18.3
	7	17	7.4	7.4	25.7
	8	54	23.5	23.5	49.1
	9	42	18.3	18.3	67.4
	Strong positive 10	75	32.6	32.6	100.0
	Total	230	100.0	100.0	

Source: Field Survey

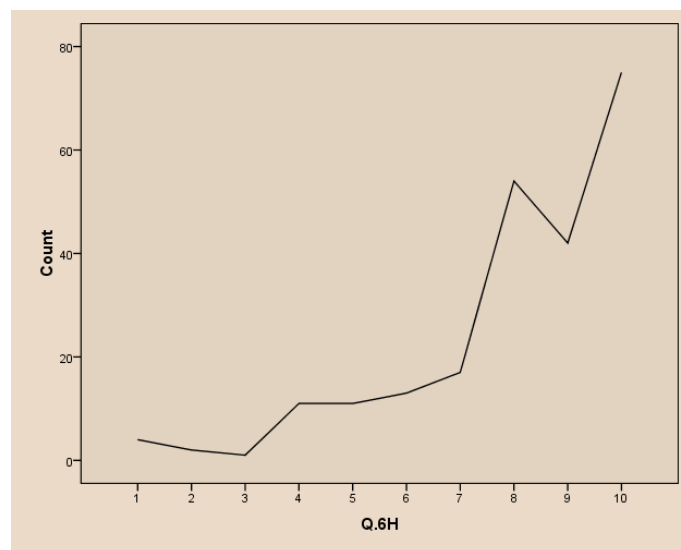


Figure-4.3, Line graph showing the inclination of the views to opt for any entrepreneurial activity

- **Inferential analysis for their views to opt for any entrepreneurial activity**

From the table 4.2 we find that confidence intervals lie entirely above 0.0. The value of 't' for the Females Farmers view to opt for any entrepreneurial activity (C) is 22.903 which is higher than 1.96. This is further confirmed by significance levels which are 0.00 and also by confidence intervals, both limits of which lie entirely above 0.0 for it. We can safely say that null hypothesis for this view is rejected and thus alternate hypothesis for it is accepted, which says that more number of sample female farmers would like to opt for any entrepreneurial activity.

Further, we conclude it by saying that significantly more number of sample female farmers on an average are interested in and hold the view to opt for any entrepreneurial activity.

Table-4.6 as well as bar diagram in figure 4.4 depict the frequency of various options sample female farmers have selected. It shows that 43% females have opted for poultry, 09% females have opted for fish farming, 39% females have opted for cow, 05% females have opted for silkworm/honey bee and 04% females have opted for others.

Table -4.6- Frequency of various options					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	POULTRY	99	43.0	43.0	43.0
	FISH FARMING	20	8.7	8.7	51.7
	COW	89	38.7	38.7	90.4
	SILKWORM/ HONEY BEE	12	5.2	5.2	95.7
	OTHERS	10	4.3	4.3	100.0
	Total	230	100.0	100.0	

Source: Field Survey

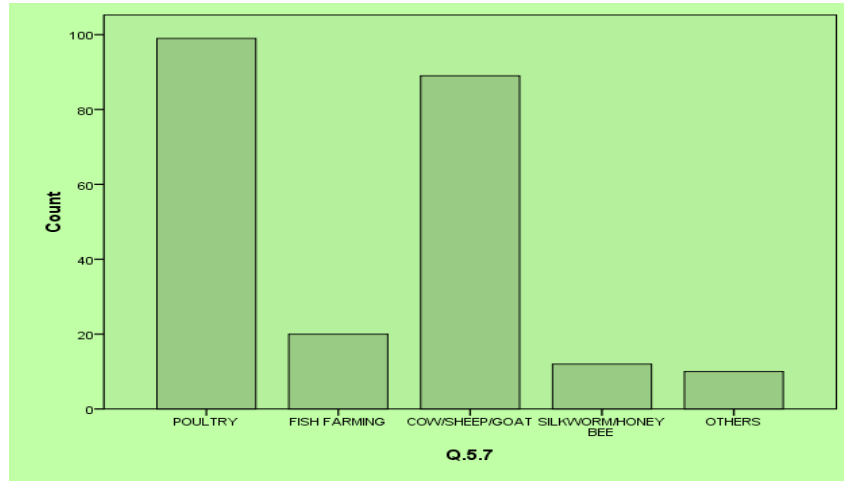


Figure-4.4, Bar diagram showing the Frequency of various options

- District wise**

In table-4.7, for district wise views to opt for any entrepreneurial activity of female farmers, it is observed that though in all the districts (except North) majority of female farmers have opted for poultry. But, within the districts, in East district dominance for this option is spotted the most and in North it is spotted the least. In all the districts (except North) second option of female farmers is cow rearing. In North majority of female farmers have opted for cow and second option of female farmers is poultry. In all the districts third option of female farmers is fish farming followed by silkworm/honey bee and others. Within the districts for fish farming, East is the district where maximum percentage of female farmers who have opted for it, is noted followed by (West and North equally) and South. West did not record even a single female who has opted for silkworm/honey bee.

Table -4.7-Q.5.7 * District Cross tabulation							
			District				Total
			East	West	North	South	
Q.5.7	POULTRY	Count	32	27	11	29	99
		% within Q.5.7	32.3%	27.3%	11.1%	29.3%	100.0%
		% within District	40.0%	45.0%	36.7%	48.3%	43.0%
		% of Total	13.9%	11.7%	4.8%	12.6%	43.0%
	FISH FARMING	Count	9	4	4	3	20

		% within Q.5.7	45.0%	20.0%	20.0%	15.0%	100.0%
		% within District	11.3%	6.7%	13.3%	5.0%	8.7%
		% of Total	3.9%	1.7%	1.7%	1.3%	8.7%
	COW	Count	28	24	13	24	89
		% within Q.5.7	31.5%	27.0%	14.6%	27.0%	100.0%
		% within District	35.0%	40.0%	43.3%	40.0%	38.7%
	SILKWORM /HONEY BEE	% of Total	12.2%	10.4%	5.7%	10.4%	38.7%
		Count	8	0	1	3	12
		% within Q.5.7	66.7%	.0%	8.3%	25.0%	100.0%
	OTHERS	% within District	10.0%	.0%	3.3%	5.0%	5.2%
		% of Total	3.5%	.0%	.4%	1.3%	5.2%
		Count	3	5	1	1	10
	Total	% within Q.5.7	30.0%	50.0%	10.0%	10.0%	100.0%
		% within District	3.8%	8.3%	3.3%	1.7%	4.3%
		% of Total	1.3%	2.2%	.4%	.4%	4.3%
		Count	80	60	30	60	230
		% within Q.5.7	34.8%	26.1%	13.0%	26.1%	100.0%
		% within District	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	34.8%	26.1%	13.0%	26.1%	100.0%

Source: Field Survey

4.4 Agriculture practices in Sikkim

Following are few figures depicting the agriculture practices in Sikkim:-



Figure 4.5

Figure 4.6

Figure 4.7

Figure 4.8

Figure 4.9



Figure 4.10

Figure 4.11

Figure 4.12

Figure 4.13

Figure 4.14

Figure 4.15

(1 & 2) Farms which are left uncultivated. In some cases the reason for it is-the land is taken over by some company for some project, in some cases-the owner does not stay on the land, in some cases-it is family land dispute and they are on the lookout for a trustworthy person to whom they can give the land on 'Adhia'.

- (3, 4 & 5) Water of 'Dhara - means spring water' is getting channeled into both the sides to fields. Under the road, it is crossing over to the other sides and by the road side water channel is made till farms. Figure 4 shows the water of this Dhara flowing over to the other side of the road. Next this water is supplied to farms through these channels (shown in figure 5).
6. Male members are busy in cutting the trees and chopping them into small pieces but making the bundles of 05-06 of such pieces of woods and carrying them in the baskets to the place of storage is done by females.
 7. The way people store wood which is used for cooking, making concentrate for animal on fire, de-moisturizing cardamom pods and for the winters.
 8. The stored wood is getting used by people for making concentrate for animal and for cooking.
 9. To make the wood ready for cooking, one lot of it is placed on the shelf above the firing place and once it is dried up, it is used and is replaced by the new lot.
 10. Corn-cobs are stored in the kitchen and get dried up both with the heat of the roof as well as of the fire place.
 11. This is the way they de-moisturize their cardamom pods. Cardamom pods are kept on the gauge above this structure. Fire is lit below it. When the pod starts splitting with the heat, cardamom is taken out of it and is dried up to make it ready for selling.

4.5 Integrated low investment rain-water harvesting

India is endowed with unique wheat germplasm (collection of genetic resources for an organism. For plants, the germplasm may be stored as a seed collection) capable of yielding satisfactorily under sub-optimally higher temperatures. The wheat varieties grown in the central and southern parts of the country carry genetic potential for tolerating usually higher temperatures prevalent in these areas during wheat growing season especially at grain filling stage. Therefore, these materials offer scope for improving varieties with respect to heat tolerance for cultivation in other parts of the country also. It has been conclusively shown that biomass production is a key factor in high grain yield performance under late sown high temperature environments (Singh and Singh, 2010).

To remove the problem of food security, low investment but high productive rain water harvesting in dry land is recommended and shown in the model as well as in the flow diagram. For this purpose, drought and pest resistant native crops which require less water can be grown in the farms. Azolla (that will thrive with very little care) can be grown in the farms along with paddy cultivation. In addition, rain water can be harnessed for storage in reservoirs through Rooftop Rain Water Harvesting and also in ponds. Azolla can also be grown in these ponds. Azolla grows very quickly in ponds and buckets, and it makes an excellent fertilizer (green manure) and garden mulch. In these ponds fish can be grown. Apparently fish and shrimp relish the Azolla. In fact, Azolla was grown for fish food and water purification at the Biosphere II project in Arizona (a 2.5 acre glass enclosure simulating an outer space greenhouse). Azolla has reportedly been used as a feed for pigs and ducks in South East Asia; for cattle, fish and poultry in Vietnam; and for pigs in Singapore and Taiwan. It is described as an excellent substitute for green forage for cattle in Vietnam and may replace up to 50% of the rice bran used as feed for pigs in that

country (*Azolla* spp., website). *Azolla* is very useful feed for cattle as well as for poultry, as it increases the milk yield in cattle and egg laying in chicken. *Azolla* is rich in proteins, essential amino acids, vitamins and minerals. Studies describe feeding *azolla* to dairy cattle, pigs, ducks, and chickens, with reported increases in milk production, weight of broiler chickens and egg production of layers, as compared to conventional feed. One FAO study describes how *azolla* integrates into a tropical biomass agricultural system, reducing the need for inputs (T.R. Preston and E. Murgueitio, 2008, Wikipedia). *Azolla* cannot survive in winters with prolonged freezing, so is often grown as an ornamental plant at high latitudes where it cannot establish itself firmly enough to become a weed. It can prove to be very useful farming system in populated countries like India as it requires more man-power being labour-intensive farming systems. Women can be gainfully employed in this type of farming system.

Plants need nitrogen, phosphorus, and potassium, as well as micronutrients and symbiotic relationships with fungi and other organisms to flourish, but getting enough nitrogen, and particularly synchronization so that plants get enough nitrogen at the right time (when plants need it most), is likely the greatest challenge for organic farmers (Watson CA, 2002). *Azolla* is very useful for refuting this challenge in the farms as it fixes nitrogen from the atmosphere which is very essential nutrient for plants, giving the plant access to the essential nutrient. This has led to the plant being dubbed a "super-plant", as it can readily colonize areas of freshwater, and grow at great speed. Some species can double their biomass in three days under optimal environmental conditions. The nitrogen-fixing capability of *Azolla* has led to it being widely used as a bio fertilizer, especially in parts of Southeast Asia. Indeed, the plant has been used to bolster agricultural productivity in China for over a thousand years. When rice paddies are flooded in the spring, they can be inoculated with *Azolla*, which then quickly multiplies to cover the water, suppressing weeds. The rotting

plant material releases nitrogen to the rice plants, providing up to nine tones of protein per hectare per year (Azolla spp., website). Azolla are also serious weeds in many parts of the world, entirely covering some bodies of water. It acts as an additional benefit to its role as a paddy bio fertilizer. Azolla has been used to control mosquito larvae in rice fields. The myth that no mosquito can penetrate the coating of fern to lay its eggs in the water gives the plant its common name "mosquito fern"(Mosquito Fern, website). The plant grows in a thick mat on the surface of the water, reducing the rate at which oxygen dissolves into the water, effectively choking the larvae (Okech, Bernard A. et. al., 2008). **If these fern colonies cover the surface of the water, then oxygen depletions and fish kills can occur. These plants should be controlled before they cover the entire surface of the pond.**

By lighting bulbs around the pond, serves as an insect trap, attract insects which fell into pond can be consumed by fishes. Even bird's droppings fell into water also serve as food for fishes. The pellets of poultry/goat/sheep shed also become food for them. Feeding types among fishes range from predatory gulpers to sifters of organic materials in mud, to zooplankton (very small animals) feeders and to herbivores that eat algae or phytoplankton (very small plants) or even leafy plants. The rationale of poly-culture is the selection of compatible species with different feeding habits. In addition, as fish learn to feed on almost anything, it is relatively easy to develop pelleted foods for fish culture, dietary quality considerations aside. At the same time, such feeding habits permit the use of plant materials, especially cheap or nearly valueless crop residues. All sorts of other wastes, even sludge, can be fed to fish (Kerns and Roelofs 1977; Viola 1977; Bayne et al 1976) with very low conversion efficiencies, but presumably favoring cheap production costs.

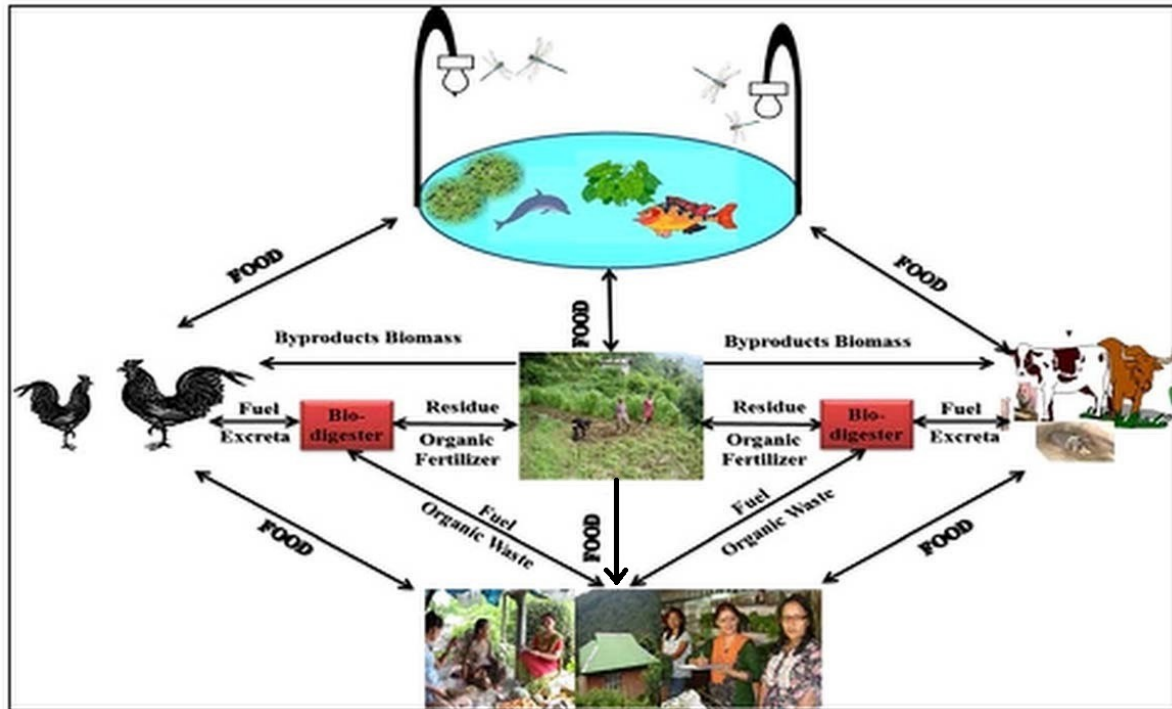
Fruit trees can be grown on the borderline of the farms. This not only provides economic returns to the farmers but also helps in checking soil erosion of the

agriculture land. The dried fallen leaves of the trees spread on land serve as effective mulches; it can help in preventing evaporation, thus retaining moisture of the soil. It also serves as shelter for earthworms which help in vermicomposting thus retaining the fertility of the soil and also act as effective weed suppressor. Most importantly it helps in mitigating the impact of climatic change and sustaining agriculture. Mixed farms with both livestock and crops can operate as ley farms, whereby the land gathers fertility through growing nitrogen-fixing plants such as azolla and grows

crops or cereals when fertility is established. Farms without livestock ("stockless") may find it more difficult to maintain fertility, and may rely more on external inputs such as imported manure.

Biological research on soil and soil organisms has proven beneficial to organic farming. Varieties of bacteria and fungi break down chemicals, plant matter and animal waste into productive soil nutrients. In turn, they produce benefits of healthier yields and more productive soil for future crops (Ingram M., 2007). Fields with less or no manure display significantly lower yields, due to decreased soil microbe community (Fließbach et al., 2006). The adoption of these multiple cropping systems rather than mono cropping system by farmers helps a long way in making them economically viable and environment friendly.

After going through the literature, a model and a flow diagram has been made.



Model of Integrated Dry land Commercial Farming by Rainwater Harvesting

- **Efficient integrated farming**

For integrated farming to give good results, it is suggested and shown in the model above that cropping system should be such which uses efficiently solar energy giving maximum biomass and also efficient in fixing carbon dioxide into biomass and also require minimum inorganic input. It should be accompanied by forage tree and integrated by domestic livestock which use local resources. Low cost biodigesters are recommended at the place of integrated farming. Though there are lots many biodigesters available in the market, but the installation and performance of low-cost polyethylene tube biodigesters on small-scale farms can be accessible at (Bui Xuan An et. al., website). This is particularly important at the places where deforestation activities happen for household fuel. Biogas produced through biodigesters at the place of Integrated Farming is helpful in using as a fuel at homes, to light bulbs in markets place, cow/ poultry sheds/fish ponds.

```

graph TD
    RWH[RAIN WATER HARVESTING] --> FM[Fruit/Mulberry Trees in the Field Periphery]
    RWH --> SC[SERI/BEE CULTURE]
    RWH --> PFA[PONDS FISH & AZOLLA PLANT]
    RWH --> BEN[BENEFITS]

    FM --> FDL[Fallen Dry Leaves Act as Mulches]
    FDL --> PSR[Prevents Soil Run off, Evaporation & Retains Moisture]
    PSR --> BEV[Breeds Earthworms & Helps in Vermicomposting]
    BEV --> FDC[Farms of Drought Resistant Native Crops]

    SC --> HM[HOUSEHOLD MARKET]
    SC --> PFA
    SC --> BOD[BIODIGESTER]
    HM <--> BOD
    BOD --> FDC

    PFA --> P[POULTRY]
    PFA --> C[CATTLE]
    PFA --> BEN

    P <--> BEN
    C <--> BEN
    C --> FDC
    FDC --> BEN
  
```

RAIN WATER HARVESTING

- FRUIT/ MULBERRY TREES IN THE FIELD PERIPHERY**
 - FALLEN DRY LEAVES ACT AS MULCHES
 - PREVENTS SOIL RUN OFF, EVAPORATION & RETAINS MOISTURE
 - BREEDS EARTHWORMS & HELPS IN VERMICOMPOSTING
- SERI/BEE CULTURE**
 - HOUSEHOLD MARKET
 - BIODIGESTER
- POULTRY**
- CATTLE**
- FARMS OF DROUGHT RESISTANT NATIVE CROPS**
- PONDS FISH & AZOLLA PLANT**

BENEFITS

- PRODUCING THE CROPS ORGANICALLY
- PREVENTING SOIL DEGRADATION
- INCREASING ECONOMIC RETURNS
- INCREASING FOOD SECURITY
- MAINTAINING CLIMATIC BALANCE
- INCREASING RURAL EMPLOYMENT

INTEGRATED DRYLAND COMMERCIAL FARMING BY RAIN WATER HARVESTING

4.5.1 Advantages of the model as well as the flow diagram given above

4.5.1.1 Bio digester helps in reducing greenhouse effect

Accumulation principally of carbon dioxide and methane are the major causes of the warming of the earth's atmosphere. Though fossil-fuel based industrial development is the major cause of the environmental imbalance; but, agricultural practices based on the most modern inorganic production technologies are also adding to greenhouse gases. Since bio digester uses substances like cattle and human organic waste which emit methane and crop residue which emit carbon dioxide on burning/decaying, it helps in preventing carbon dioxide and methane from spreading into the atmosphere directly. Thus, this system helps in reversing the greenhouse effect by utilizing the resources which are provided by the nature (like biomass, animal and human organic waste) and also are combined sources of fuel and feed which helps in reducing the dependency on fossil fuels and chemical fertilizers.

Organic agriculture helps in mitigating and even reverses the effects of climate change. Organic agriculture decreases fossil fuel consumption and sequesters carbon in the atmosphere. The elimination of synthetic nitrogen in organic systems decreases fossil fuel consumption by 33 percent and carbon sequestration takes CO₂ out of the atmosphere by putting it in the soil in the form of organic matter which is often lost in conventionally managed soils. Carbon sequestration occurs at especially high levels in organic no-till managed soil (LaSalle et. al.2008). Agriculture has been undervalued and underestimated as a means to combat global climate change. Soil carbon data show that regenerative organic agricultural practices are among the most effective strategies for mitigating CO₂emissions (LaSalle et. al.2008).

4.5.1.2 It Helps in producing the goods organically

"Organic agriculture is a production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved." (IFOAM, Websites)

Organic farming is the form of agriculture that relies on techniques such as crop rotation, green manure, compost and biological pest control to maintain soil productivity and control pests on a farm. Organic farming excludes or strictly limits the use of manufactured fertilizers, pesticides (which include herbicides, insecticides and fungicides), plant growth regulators such as hormones, livestock antibiotics, food additives, and genetically modified organisms.

The model and the flow diagram given above will help in producing the goods organically.

4.5.1.3 It helps in increasing the crop yield in a unit area in a sustainable way

Sustainable agriculture is the method of doing agriculture which integrates three main goals, environmental health, economic profitability, and social and economic equity. These are broadly the goals which have been defined by a variety of philosophies, policies and practices, from the vision of farmers and consumers. But the perspectives and approaches may diverse.

Agriculture in India has got transformed from subsistence farming till late 1960's to commercial farming since early 1980's. But during the initial decade of the adoption

of green revolution, chemical fertilizer was used heavily to increase the production which is not sustainable. Presently, though the use of it has been reduced but efforts are on to eliminate it completely to ensure sustainability. During the periods 1950-2010 agriculture production especially food grain production has increased from 50 M tons to 220 M tons. It was possible only with the adoption of new technology (Kumaraswamy and Khan, 2010). Along with it, research and development activities also contributed a lot to increase yields and decrease inputs so that smaller land area can also generate more returns. It also helped India in achieving self-sufficiency level. But, the population which is expected to reach 1.8 billion in 2050 and demand for food is increasing continuously with increase in human and animal population and arable land which is continuously decreasing with the commercial use of land (Kumar Ananda P., 2010). Also raising the produce organically is very important for sustainable agriculture. So, the need of the hour is to maximize crop production in a unit area in a sustainable way at reasonably low cost without undue exploitation of natural resources, through proper soil and water conservation measures and by adopting appropriate integrated soil management practices.

Scientific Review by Cornell University into a 22 year-long Field Study has shown the following results (Pimental et al 2005):

- a) The improved soil allowed the organic land to generate yields equal to or greater than the conventional crops after 5 years.
- b) The conventional crops collapsed during drought years.
- c) The organic crops fluctuated only slightly during drought years, due to greater water holding capacity in the enriched soil.
- d) The organic crops used 30% less fossil energy inputs than the conventional crops.
- e) Although labour inputs average about 15% higher in organic farming systems (ranging from 7% to 75% higher), they are more evenly distributed over the year in organic farming systems than in conventional production systems.

The model which has been given above helps in sustainable agriculture.

4.5.1.4 It can be helpful in tackling solid waste management and deforestation problems

As is discussed in the section 2.2, solid waste collection in the inaccessible houses and in the outlying areas, which are very much urban but are, not covered under the jurisdiction of notified town area, is a pressing problem of the state. It is also depicted in the table 2.7 that though the percentage figures of use of fire-wood for cooking as a total in the State have registered a decrease in the decade, but the same has shown an increase in the urban and only a marginal decrease in the rural area. This is a clear indication of deforestation activity, though it is banned in the State. Therefore, if converting biodegradable solid waste into fuel through the use of bio digester can be taught to such inaccessible lot by the agriculture department, then this model can be proved useful in tackling solid waste management and deforestation problems.

4.5.1.5 It justifies farm mechanization

In the modern age talking of non-mechanization will be unjustifiable even if any country is overpopulated or the area is hilly. Also, it is increasingly very difficult and expensive to rear animals especially bullocks even in the rural areas by resource poor farmers. There are no common resources available any longer such as common forests or grazing lands so farmers have to go for confined feeding that means higher costs hence it is not feasible at all. Hence animal husbandry is no longer feasible option for ploughing. With the above model along with mechanization, one can go for animal husbandry also. But, finding the alternate ways for the displaced labour in case of mechanization and also operating the machine optimally is a very important. The study of (Mishra and Sundram, 1975) compared the cost of harvester combine with other alternative technologies and found it to be unprofitable unless farmers take third crop in a year. The study also assessed the cost and benefits of harvester

combines. It was estimated that the use of harvester combine resulted in saving of about 15 man days of unskilled labour per acre. The labour displaced by this can be absorbed in meeting the demands of more unskilled labour which is required at the place of integrated farming. It is of utmost importance to examine whether the use of machines has been economical or not. Since integrated farming shows good results with multiple cropping rather than mono cropping, so, it justifies farm mechanization. On the basis of a study covering 203 farmers having 218 tractors in different districts of Punjab (Singh and Jindal, 1993) it was brought out that the total use of the tractor, which on an average came out 397 hours per annum is much less than the possible extent of 1000 hours. The cost per hour turned out to be very high due to high fixed cost, which can be reduced by increasing the hours of working of the tractor. If it finds work for 600 or more hours per annum, the cost per hour can be lowered significantly.

The overall average cost/hour, which was Rs.103.04 by its existing quantum of work i.e. 397 hours declines to Rs.91.77, Rs.86.26 and Rs.82.97 by working per 600, 800 and 1000 hrs. per annum.

The machine becomes economical only if it is gainfully employed for rather than accounting for its unproductive use. The labour displaced by this can also be absorbed in agro-business by making them trained in the new technologies to reduce post-harvest losses through appropriate postharvest operations including grading, value addition, packaging, processing and transportation so as to get remunerative price to the farmers.

5. Conclusion and Recommendations

Sikkim is a land of villages and agriculture was and is a way of living, but still is in evolving shape and faces a variety of challenges like - data in section 1.2.5 about workers profile reveals that a majority of women in Sikkim are small/medium farmers. Owing to this, the sample female farmers reported that subsistence farming is prevalent here and production is mainly done for consumption purpose. In the absence of good marketing facility the farmers grow a little bit of everything that they require. Low scale of operation does not generate much surplus to be taken to the market. That is why the data in section 4.1 shows that no more number of sample female farmers are satisfied with the income they get from their farm.

Nonetheless, agriculture is the main economic activity of all the districts in the state, but, the initiation of off-farm income-generating activities to supplement their income is deemed an essential shift for rural folk for the reason that i) the small land holdings in the State does not generate much income ii) hardship faced by the people due to hilly terrain and iii) most importantly tertiary as well as the industrial sector is developing providing more gainful employment at these places facing less hardship than the farming sector.

The problem of land absenteeism which hinders the development of land and the productivity is there because the tenants (to whom the land has been given on 'Adhia'), who actually cultivate the land take little care for its development and increasing its productivity. Sometimes the farms are left uncultivated also as is shown in figures 1 and 2 in section 4.4. The reasons reported by sampling units for the land left uncultivated are-the land is taken over by some company for some project/the owner does not stay on the land/it is family land dispute and in some cases the reason for it is that the owners are on the lookout for a trustworthy person to whom they can give the land on 'Adhia'.

Apart from depending upon monsoon (is shown in figures 3, 4 and 5 of section 4.4 in about monsoon water getting diverted into channels for irrigation purpose); agriculture sector also faces the problems of climatic change because of global warming. Poor quality of seeds, excessive rains/floods causes soil erosion. Cutting of trees and removal of vegetation etc. exposes the land to wind and rain, soil degradation are the other problems. For the sake of industrialization and urbanization, more and more trees have been cut, leading to global warming and causing imbalance in climatic conditions thereby making farming occupation even harder. Himalayan glaciers are also receding at the fastest rates in the world due to global warming, threatening water shortage for millions of people particularly in India, China and Nepal. Agriculture is prone to all possible hazards which often end up in disasters thereby making rural life miserable and forcing people to shift to the urban areas in search of earning a livelihood.

In general, most of the rural people are illiterate, conservative and bound by outmoded customs, superstitious, believe in caste systems and have inadequate financial support and access to the market.

The present study has been carried out with the help of primary source of data. The study has assessed the female farmers view to opt for any entrepreneurial activity to augment their income except agriculture in Sikkim State of North- Eastern India. The findings derived from the primary source of data are substantiated by the literature review done and also with the mountainous countries of the other region if found any during the literature review. Our analysis has yielded the following conclusions:-

5.1 Conclusion

- **Female farmers keen to involve in allied entrepreneurial activities**

On the basis of the questions which were asked to have deep information about sample female farmer's views, it can be concluded that because of generating less income (section 4.1) and the hardship faced by them in performing these activities, they hold the view of doing anything except agriculture (section 4.2). Also more number of sample female farmers would like to opt for any entrepreneurial activity (section 4.3). Dwivedy Nidhi et al, (2012) also share the same opinion for income generation in agriculture.

The frequency for various options which sample female farmers have selected to augment their income in table 4.6 shows that 43% females have opted for poultry, 09% females have opted for fish farming, 39% females have opted for cow, 05% females have opted for silkworm/honey bee and 04% females have opted for others.

- **Reasons Given by Sample Female Farmers for Such Options:**

I. Cow

- a) Since childhood, familiar with such type of work and easy also.
- b) Helps in integrated farming. (Benefits: milk products and manure).
- c) Easy to maintain and helps in making money also.

II. Poultry

- a) It is easy to maintain and helps in making money also.
- b) The State Government provides it (the whole kit) free of cost.

III. Fish Farming

- a) There is abundance of water in the area.

IV. Silkworms/Honeybees

- a) It is an easy farming with low investment, and helps making money also.

V. Others

- a) Want to run a hotel for village tourism.
- b) Want to run a stall next to construction sites for selling snacks and tea etc.

The district wise data for views of female farmers to opt for any entrepreneurial activity in table 4.7 shows that though in all the districts (except North) majority of female farmers have opted for poultry. But, within the districts, in East district dominance for this option is spotted the most and in North it is spotted the least. In all the districts (except North) second option of female farmers is cow rearing. In North majority of female farmers have opted for cow and second option of female farmers is poultry. In all the districts third option of female farmers is fish farming followed by silkworm/honey bee and others. Within the districts for fish farming, East is the district where maximum percentage of female farmers who have opted for it, has been noted followed by (West and North equally) and South. West did not record even a single female who has opted for silkworm/honey bee.

At the end, we can sum it up saying that after the adoption of LPG (Liberalization, Privatization and Globalization) policies in 1991, all sectors are exposed to competition (domestic as well as foreign), and so, is agriculture sector. Moreover, there is increasing demand for higher-value fresh and processed agricultural products

nationally and internationally. In order to make the sector lucrative and income generating so that it helps in improving the socio-economic condition of its contributors (abundance of which are of course women), it is very important that the challenges of this sector should be tackled by finding out the innovative ways, on priority basis and the real challenge of building a sustainable agriculture starts here.

Subsequently, there is need to promote economically viable, socially acceptable, environmentally non-degrading, and technically sound use of country's natural resources – land, water and genetic endowment to promote sustainable development of agriculture. Measures should be taken to prevent soil run-off and erosion by making the use of land for agriculture and afforestation. Multiple-cropping and inter-cropping instead of mono-cropping practices should be adopted. The use of bio-technologies should be promoted for evolving plants which consume less water, are drought resistant, pest resistant, contain more nutrition, give higher yields and are environmentally safe. A major thrust should be given to development of an integrated rain fed diversified agriculture along with animal husbandry, bee-keeping, poultry, dairying and aqua-culture which will help in generating wealth and employment in agriculture sector. Handling agriculture the way it is suggested through the model as well as in the flow diagram discussed in section 4.5 can be of great help in this regard.

In order to improve the socio-economic condition of its main contributors i.e. farming females in the state of Sikkim, data was collected from all the four districts, analysed and concluded for their views, so that befitting suggestion can be worked out for them.

5.2 Recommendations

Following is the suggestion for sample farming females of the four districts of the state of Sikkim.

- **Government to help in promoting the use of bio-digester to save female's time of fuel collection to be utilized in other productive chores**

Even though the gas connections have been distributed by the State government, still the vast majority of rural women still depend on the locally available non-commercial sources of energy such as fuel wood. Despite the state government's policy of banning the deforestation activities, trees are being cut and widely used by inhabitants for cooking, making concentrate for animal on fire, de-moisturizing cardamom pods and for the winters. The same thing has been shown in section 4.4 of (Figure 6-11). Table 2.6 and 2.7 in section 2.2 also depicts that though the use of LPG for cooking has increased from 19 to 41 percent, but the use of fire-wood for cooking has been decreased only from 65 to 53 percent over a period of ten years. In practically all third world countries the problems of getting enough food to eat began to be overshadowed by the problems of acquiring the energy needed to cook it. Hence, this strategy is not sustainable as it pollutes the atmosphere thereby leading to global warming; the more appropriate option which is suggested in this case is to convert the manure to biogas through anaerobic digestion as suggested by the researcher in the model given in section 4.5. As the state has been declared an organic one, also the data showed possessing and rearing of milch animal by every household, so after making use of livestock dung in making biogas in the suggested manner the same can be applied in farms to produce the crops organically. The biogas can be used to satisfy household fuel demand instead of the fire wood that before was used as fuel for cooking and helps women in increasing the quality of life by saving

time and energy and physical fatigue which earlier used to get wasted due to collection of fire-wood.

It will also help in checking deforestation thus maintaining Himalayan climate and also in preserving numerous herbal species of plants. Time saved by adopting these measures can be utilized in some other productive chores like (marketing, processing) rather than in collecting fuel/firewood. Considering the impact of environmental factors on their livelihoods, women's participation should be ensured in the conservation of the environment and control of environmental degradation thus maintaining climatic balance.

5.3 Scope for future research

A review of research work done on this topic shows that the following areas can be identified as potential for future research.

5.3.1 Problems and prospects in creating other income generating activities for rural women

Since significantly more number of sample female farmers have opted for doing any entrepreneurial activity to enhance their income for improving their socio-economic condition. Hence, few activities like food processing business, milk processing, poultry/fishing industry, and sericulture have been suggested for them (Dwivedy Nidhi, 2012, Pp 313).

Problems and prospects faced by rural women in creating such income generating activities provide the basis for future scope to be studied.

- **Milk processing-**

The export of dairy products has been growing @ 25% per annum in terms of quantity and 28% in terms of value. So, it provides a great scope for the manufacturing of value added milk products like milk powder, packaged milk, butter, ghee, cheese and ready to drink milk products. The presence of healthy casein of type A2 offers great scope for export of cow's milk and milk products from India.

The data collected by the researcher did not find even a single sampling unit who is not rearing milch animal (cow)/ not selling milk. Since the state has been declared an organic one, so, things including milk are produced organically here. Milk by-products viz. cheese, churpi, ghee, paneer etc. are produced locally but in a limited scale. In Sikkim an autonomous body under the name of Sikkim co-operative milk producers' union limited has been established. Milk is handled through 150 milk societies in the state.

Since organically produced things are in great demand nationally/internationally, it can even help them in earning foreign exchequer also if handled properly and operated commercially under some expert supervision of animal husbandry department. This act will definitely make them economically independent and becomes the scope for further study.

- **Poultry/fishing industry-**

Fish farming provides many profitable opportunities. On the commercial level, the raising and selling of fish has proven to be economically successful at many places. The healthy farm-reared fish, guarantee free of diseases, pesticides and other harmful toxicants is more desirable substitute for the wild fish from potentially polluted waters. Fish farming requires special knowledge, skills, and careful considerations.

There is also great scope for women to earn money by rearing fish. As 9% of the females have given their choice for it, therefore small scale fish farming as is suggested in the model in section 4.2.10, can be proved beneficial and economical to the small land sized female farmers. Farming with Azolla requires more man power being labor-intensive farming systems. Women can be gainfully employed in this type of farming system. Therefore, pisciculture with this type of integrated farming involving women provides the basis for future study.

- **Sericulture**

Sericulture is an eco-friendly agro-based labour intensive rural cottage industry. Also the services of women are required more in this industry. More number of women get involved in mulberry cultivation as well as in silkworms rearing houses. Though the sericulture programme has been implemented in the state and the Sericulture Department of Sikkim promotes exports of silk from Sikkim, yet there is not enough manpower that is skilled and capable to make use of the opportunities as people do not have the required capacity or the skill for that. So, if guided properly female farmers can harness it fully to multiply their income. Mulberry trees if grown in a manner as suggested in the flow diagram will help in integrated farming. Any problem faced by females while conducting this activity can get a solution from sericulture department or (<http://www.csb.gov.in/faq/csrti-pampore>) can be referred. Solutions by the department for the problems faced by the farmers of Pampore while conducting mulberry cultivation for sericulture are given on this site. This is also given in the literature review.

But to get the optimum results from this activity, training of women in sericulture by extension personnel is very important as they need close help and constant encouragement to acquire skills in sericulture. Special training and attention can be

taken from Women Sericulture Cooperative Society to organize and support the women, who are interested to take up sericulture as their main income generating source. Women in the venture will provide the scope for future study.

- **Food processing business –**

With continuously growing middle class, incessantly expanding secondary and tertiary sectors, busy working schedules with both spouses working and rigid food habits, the demand for packaged chapaties, quick cooking rice, packaged ready to heat and eat dals and curries, though produced at small scale but using modern packaging and handling technology is going to get increased in the due course of time.

Sikkim is an apple/orange growing state. Because of the suitable climate for apple growth in the North district, it is grown in that area the most. It will help in integrated farming if grown in a manner as suggested in the flow diagram. Unskilled women labour can also be employed in these orchards productively.

During hailstorm/heavy rains so many unripe fruit fall on the ground. They can be taught the alternative innovative uses of this fruit like making different types of achar, murabba, chutney with them. Also very valuable phytochemicals which are used to fight cancer can be extracted from unripe apple. This way, along with getting gainful employment for collecting raw fruit, farmers can get even economic returns from their fallen fruits.

If guided and trained properly using extension workers, women can harness opportunity in this upcoming area and also becomes the scope for further study.

- **Avenues in floriculture (Saffron)**

Floriculture is one of the allied sectors of the agriculture. It is believed that if females are employed in this noble sector, it will flourish more. For the simple reason that flowers are being nurtured by nature and females, who also nurture their families, can help in exploiting the plethora of potential waiting to be tapped and efficiently running of this sector. In Sikkim, there are 4500 species of flowers. To promote Sikkim at the international level, an international show is also held in the state. At present, Sikkim is producing cut flowers, which includes roses, Lilium and Anthurium on a commercial scale. Sikkim is the only state in the country which produces high value cymbidium orchids. It has also been designated as the agriculture export zone with particular emphasis on production and export of large cardamom, ginger and cherry pepper.

Besides this, as is seen in literature review, saffron is cultivated in Pampore town of Pulwama district in the state of Jammu and Kashmir, located at 34.02°N 74.93°E and has an average elevation of 1,574 meters (5,164 feet). It is one of the only four producers of saffron in the world. It produces world famous quality saffron. Along with employing women in this noble venture it fetches them good return, as it is sold at a very high price. If saffron is cultivated on the pattern of Pampore in the area of same elevation and climatic conditions as of Pampore in Sikkim also, it will help in earning a good amount by meeting the intensified demand throughout the globe. Women in this activity in Sikkim provide the scope to be studied.

- **Summary**

In view of the critical role of women in the agriculture and allied sectors, as producers, concentrated efforts should be made to ensure that benefits of training,

extension (Dwivedy Nidhi, 2013)² and various programmes should reach them in proportion to their numbers. The programmes for training women in soil conservation, social forestry, dairy development and other occupations allied to agriculture like horticulture, livestock including small animal husbandry, poultry, fisheries etc. should be expanded to benefit women workers in the agriculture sector.

With a strong focus on gender equality, there is a requirement to sustain a global effort for education as well as developmental programmes for the upliftment of the women. The goal of any developmental policy, programme or project should be directed towards enabling the women in learning a skill, literacy and earning income to support their family in particular and in building social capital for the balanced progress of any country/state. Such kind of endeavours directed towards the womenfolk will lead to a positive change in their social and economic status, life, attitude, and behaviours ultimately leading to the development of the rural economy. It would be a very long drawn and difficult battle but the reward is worth the effort.

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